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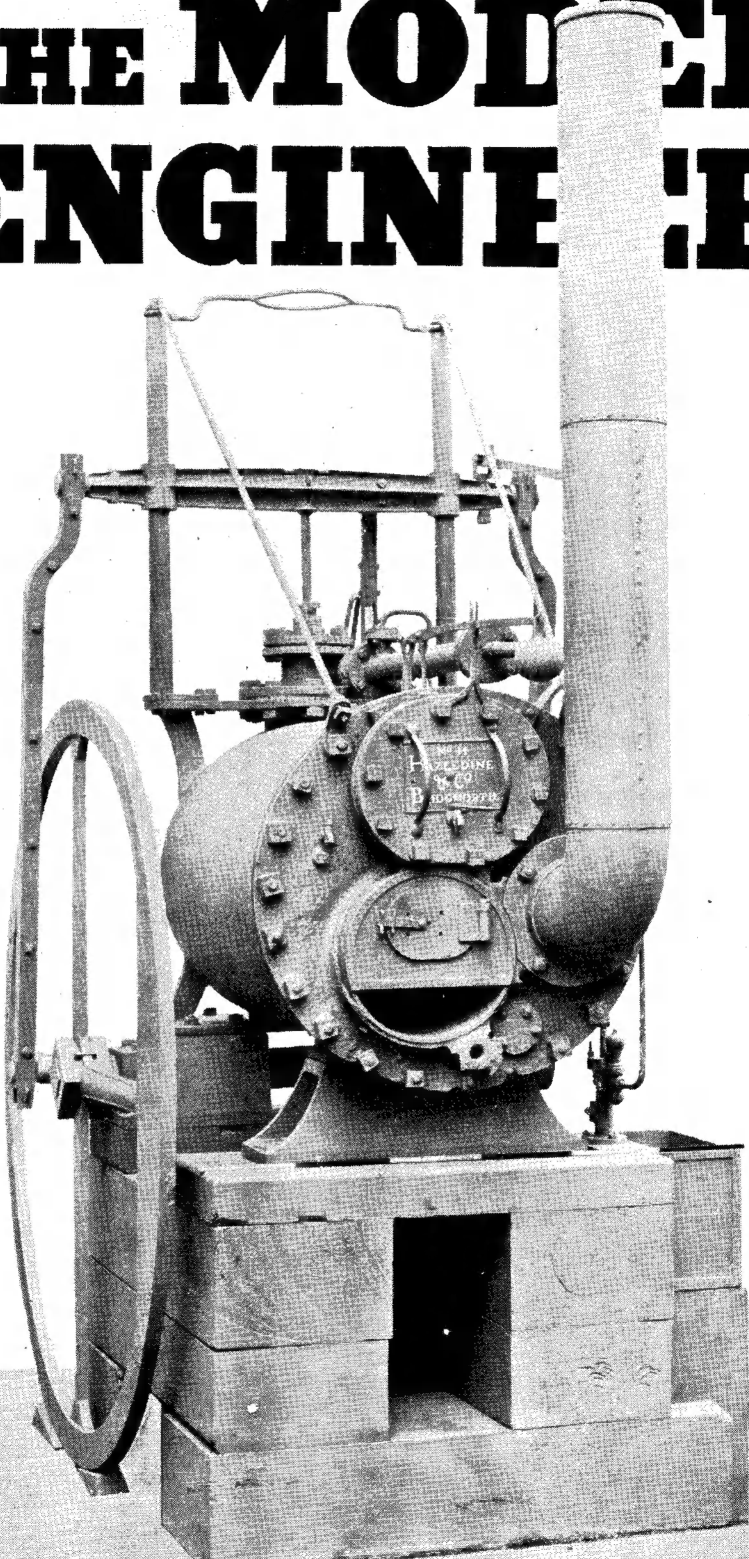
THE MODEL ENGINEER



The MODEL ENGINEER

PERCIVAL MARSHALL & CO. LTD., 23, GREAT QUEEN ST., LONDON, W.C.2

28TH FEBRUARY 1952 VOL. 106 NO. 2649

SMOKE RINGS

Our Cover Picture

● ALL STEAM enthusiasts should be interested in the photograph this week. It is a magnificent shot of Trevithick's direct-acting, high-pressure steam engine and boiler, patented by him in 1802 for locomotive and stationary use, which eventually superseded the beam engine.

The actual engine shown was found at Hereford in 1882. It was made about 1805, and probably developed 7 h.p. with steam at 50 lb. per sq. in.

The photograph appears by courtesy of the Director of the Science Museum, South Kensington.

Apologia

● IT HAS been brought to our notice that, in connection with the article "Round Town in the 'Nineties," published in our issue of December 6th last, the cover picture and the halftone illustrations on pages 736 and 737 are Crown Copyright and that no acknowledgment of this appeared with them. We take this opportunity of offering our sincere apologies for the omission and we trust that it has caused no inconvenience to anyone concerned, particularly the Science Museum, South Kensington.

Something of a Record

● WE WERE considerably astonished and interested to receive just lately an enquiry for the "M.E." screw-cutting indicator, originally brought out by us in 1909; moreover, the querist included in his letter an actual cutting of the original advertisement! The indicator was a very simple little gadget rather after the manner of a circular slide-rule, but, of course, vastly less complicated; it was made in three patterns to suit lathes with two-, four- or eight-thread guide screws, respectively, and it sold for the princely sum of 2d. It showed at a glance what wheels to put on the lathe in order to cut any desired thread.

The advertisement was worth a little study; it was headed: "Screw-cutting Made Easy," in heavy type; then below that was a drawing of the indicator followed by particulars of its use and cost. Our address, printed at the bottom of the panel, was then: 26-29, Poppin's Court, Fleet Street, London, E.C.

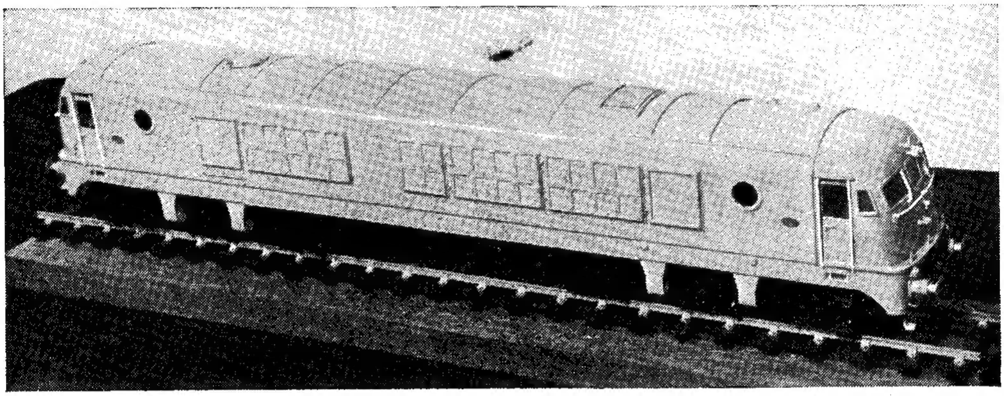
What a flashback into the past! We are well aware that the drawing power of THE MODEL ENGINEER as an advertising medium is enormous, and it always has been; but to receive an enquiry accompanied by the original advertisement in respect of goods produced by us 43 years ago is, in our experience, a record!

Model Grand Prix Alfa

● IN ANSWER to innumerable requests from readers for further information regarding the drawings of the "M.E." Model Grand Prix car, the 1½-litre type 158 Alfa Romeo by Rex Hays, we can now announce that a third sheet of details has been added, completely dimensioned. The set now comprises one General Arrangement Drawing, the Chassis Layout Drawing, and the Detail Sheet. All drawings are full size, 1/12th scale, and the price for the set is 7s. 6d. net.

New Gas-turbine Locomotive in Miniature

● THE PHOTOGRAPH reproduced on this page shows a model of the second gas-turbine locomotive for Britain, No. 18100. The model was built by H. Clarkson, of York, for Metropolitan-Vickers Ltd., who designed and built the full-size locomotive, and was exhibited at the South Bank exhibition last year. It is made to 10-mm. scale and is shown painted in its " festival " colours of grey and black. All the visible external details are very accurately reproduced, the particulars having been supplied, of course, by Metropolitan-Vickers Ltd. Mr. Clarkson has built two of these 10-mm. scale models and, in addition, a ½-in. scale one in section of the same locomotive; this third model was recently on view at Metropolitan-Vickers' premises in Aldwych, London, where it attracted much attention. We understand that it is now going to Cape Town for exhibition.



A Sad Story

● THE FOLLOWING letter has been received from Mr. A. E. F. Spence, of Wynberg, South Africa, whose name will be known to our regular readers :—

" I don't like to confess myself an ass, although I have repeatedly been assured that this is so (loud cheers from the Anti-Spence Society in Cape Town, Jo'burg and elsewhere !). But the fact is that these people have got something.

" Today (time of writing), having carefully cut an internal thread much too loose, and having turned several diameters incorrectly, I thought I would round things off by making a couple of ¼-in. dia. reamers, for use on the next part of the job. So I looked in the drawer where I keep my silver-steel and, sure enough, on the top was a nice piece, ¼ in. dia. about 8 in. long—just right. It miked up to about two ten-thous. over ¼ in., perfectly round and straight, so I set to work and soon produced two nice half-round reamers.

" Now I made a fire in the kitchen range, which soon made the kitchen very hot indeed, and popped my reamers in, then waited. In no time they were bright red, so I whipped them out and plunged them into cold water.

" I tried them with a file. Alas, they were as soft as I was. Why was this ? Because they were made of *stainless* steel, not silver-steel ! Nor could I say a word, because it was Sunday. The wretched stuff looked just like silver-steel, and only showed its perfidious nature after heating. Instead of the deep blue of silver-steel when heated it was a very light golden brown, no oxide at all. When put on a grindstone, the difference is also apparent, as the sparks from stainless steel are much less in quantity than from silver-steel.

" But failing either of the above, what can one do ? Is there any other simple test for stainless steel ? Do tell me, Mr. Editor, for if this happens again (as it probably will), I shall say what I didn't say last time—Sunday or no Sunday."

What can we say ? Mr. Spence has mentioned the only two simple tests that we know—and, we would add, we should have applied one or other, or both—just to make quite sure—*before* making the reamers (!). But we are prepared to discover that some readers may know of other tests which, preferably, should not involve the use of acids.

A Society for Wanganui, New Zealand

● A RECENT letter from Mr. N. M. Izard informs us that the Wanganui Model and Experimental Engineering Society has been formed with some 50 members. We learn that, in the process, much hidden talent and enthusiasm were discovered, particularly in locomotives and speed boats.

One of the vice-presidents of the new society is Mr. S. C. Shenton, whose 3½-in. gauge locomotive was described and illustrated by "L.B.S.C." in THE MODEL ENGINEER for August 9th last.

Mr. Izard writes : " Our membership includes several doctors, farmers and professional engineers, both motor and general, and quite a number of junior members. I am the sole representative of the law, but whether that has anything to do with my office of president I don't know."

The hon. secretary is Mr. B. C. Major, c/o Bank of New South Wales, Wanganui. The new society appears to have got away to a good start, and we wish it every success ; we shall be glad to have further news of it in due course.

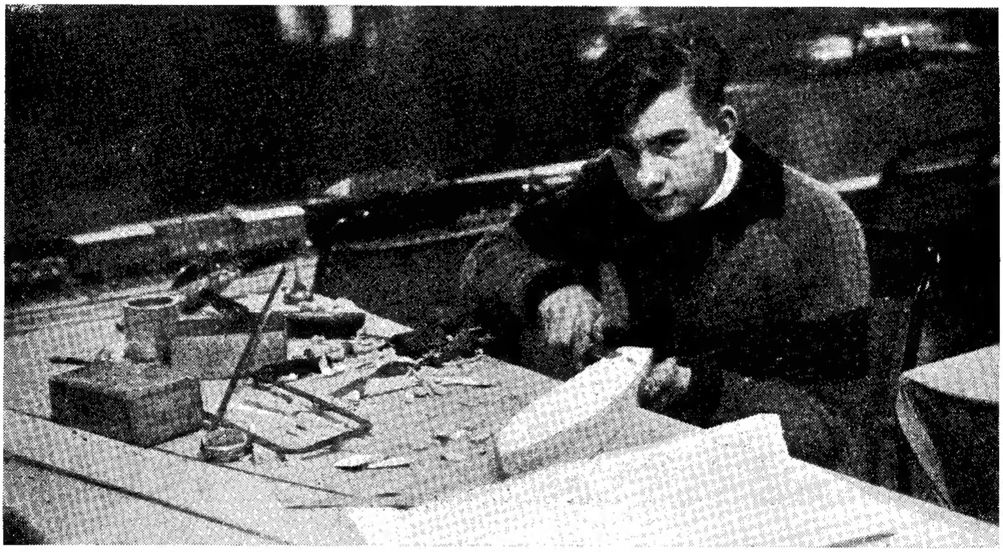
THE ROMFORD M.E. CLUB EXHIBITION

(Photographs by Frank E. Markham)

THE Romford Model Engineering Club's annual exhibition again reflected the thorough organising and hard work of chairman Mr. L. Chilver and his small committee, a great variety of interests having been catered for without sacrificing the usual high standard of workmanship which we have begun to anticipate at these shows. As with all club exhibitions, the locomotives were very much in evidence, especially those designed by "L.B.S.C.," but the marine section under the stewardship of Messrs. Whitten and Duffin ran them a close second with more than thirty exhibits. Among these was Mr. D. H. Chaddock's flash-steam turbine hydroplane, the turbine which was recently described in this journal.

Edgar Killey repeated his previous achievement in piping up his stand with some twenty models running on compressed air, the compressor being housed in another part of the building. The steam fraternity, not to be outdone, kept a 1¼-in. scale traction engine in steam throughout the show, together with Mr. R. Simmons's 2½-in gauge Canadian Switcher which was jacked up and ticking over near the locomotive track, and Mr. E. Powell's vertical coal-fired boiler and plant.

Of course, the noble stud of locomotives operating the passenger-carrying track added their contribution to the aroma which was beginning to delight the model engineering nostrils. But the "all made to work" department did not cease its activities here, for on the stage and in the entrance hall were exhibitions of radio control, whilst miniature racing cars were shown running tethered on a circular track operated by Mr. E. J. Wreford.

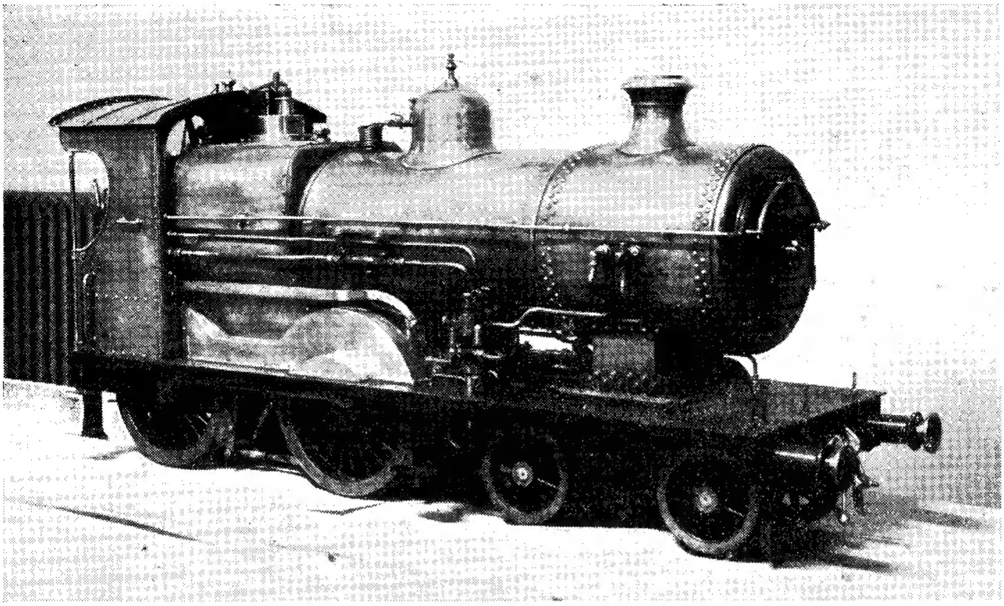


A hull-carving demonstration by a member of the Hornchurch Club

In the clubroom behind the stage was the cinema, provided and run by Frank Greenslade who supplied an appropriate running commentary over a loud speaker placed below the screen. This personal touch proved superior to a standard talkie arrangement, since the operator's remarks could be varied to suit a particular audience, and certain film characters talked back to the viewers at the appropriate times, because many of the films were of the club's activities, and the "actors" were sometimes sitting among the audience.

The local aircraft interests were not neglected, for apart from the fine models displayed in the main hall, flying demonstrations were given on the floodlit tennis court immediately outside, the aircraft looking like giant dragonflies as they buzzed into the rays of the powerful lamps.

When one's interest had been satisfied by the models, there was the workshop where one could chat to the operators behind the protective wire fencing, or watch a demonstration by Miles Smith who was operating an Echo Sounder,

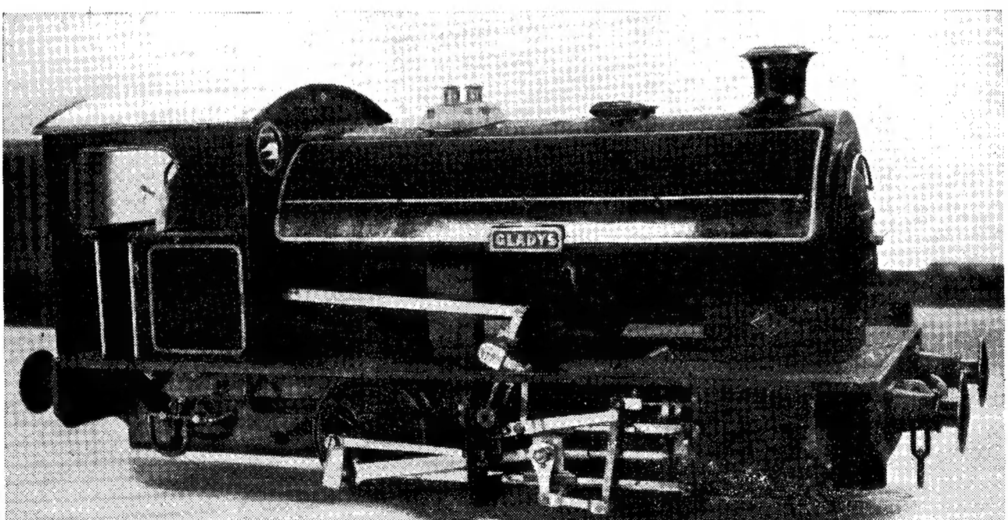


A 7½-in. gauge locomotive built by Mr. L. Polychroniadis

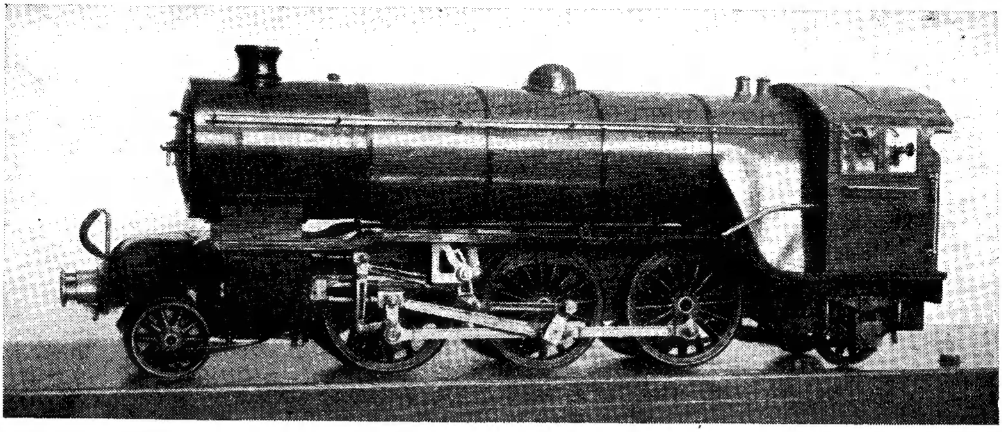
which was kindly loaned by Messrs. Hughes and Son the manufacturers. This apparatus was operated in such a manner that the ceiling of the hall became the equivalent of the sea bottom.

A stroll to the other end of the hall brought facilities for making a wire recording of one's voice and hearing it played back immediately. Nearby was a full-size two-manual electronic organ, in course of construction by Mr. J. Clarke, and sufficiently advanced for the builder to give demonstrations.

No model engineering venue can be considered complete unless refreshments are available. Romford is never lacking in this respect, thanks to the splendid hall and club facilities, and the activities of the ladies who provided a non-

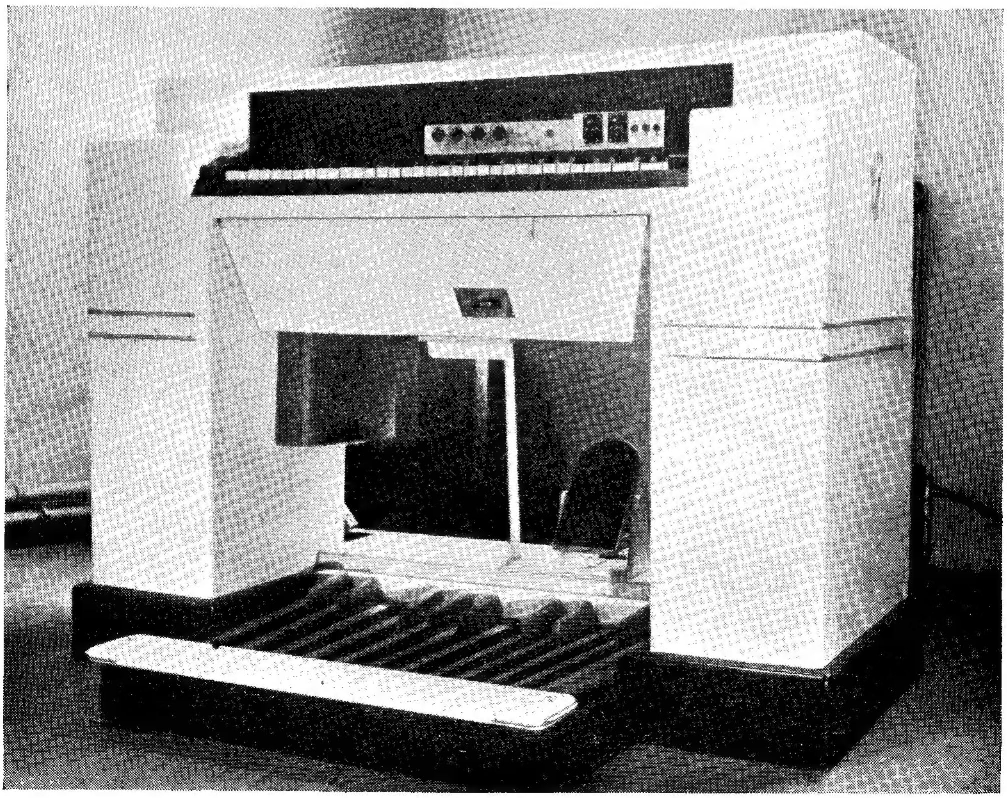


A 5-in. gauge saddle tank locomotive by Mr. J. F. Bruton



Mr. W. Killey's " Bantam Cock "—tender not yet constructed

stop refreshment service. What is equally important, comfortable seating accommodation was available where one could imbibe at leisure, or take the weight off one's feet whilst exchanging pleasantries with old so-and-so whom we had not met for years. You meet these old hands at every show, and a quiet corner clear of the " traffic lanes " should be available. The Romford club is grateful to the private individuals who loaned models, and to the neighbouring clubs and societies who added to the success of the exhibition.—F.E.M.

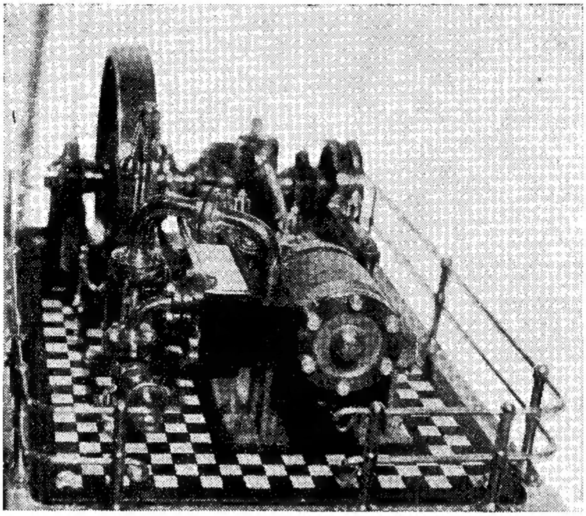


Mr. J. Clarke's electronic organ

A Model Horizontal Engine

by J. A. Newton

I HAVE been a regular reader of THE MODEL ENGINEER since 1949 and this has given me hours of pleasure in reading, also studying the pictures of different models, especially stationary steam engines. Late in 1949, I was very inspired by all these and decided to "have a go"; the result has given me much pleasure.

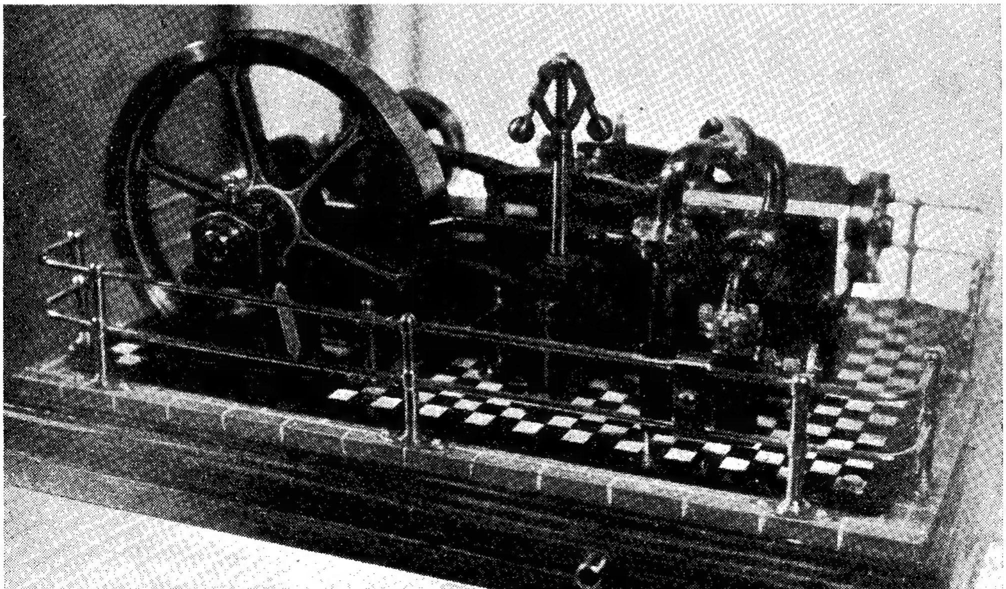


I had no drawings to work from, only memories of what I had seen in the "M.E.", which made the job a little trying and made me think twice before carrying out any operation; so the total time taken to complete was 550 hours. I think this is a record for a first attempt.

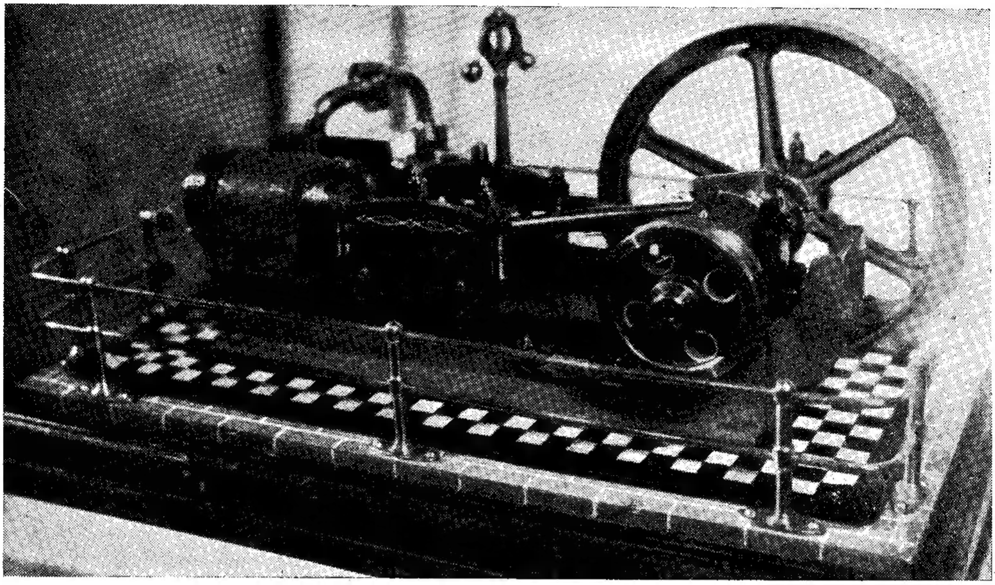
The engine weighs 22½ lb. The steel baseplate, 13 in. × 8 in. × ⅛ in., is bolted to an imitation brick bed 14 in. × 9 in. The girders for the engine to be built on were made from 1½ in. × ⅛ in. flat mild-steel with 1 in. × ⅛ in., flat mild-steel brazed on the edge of 1½ in. flat, making two girders 9 in. long 1½ in. × 1 in. ground parallel.

Flywheel was made from 6 in. solid round mild-steel bar, cutting the spokes separately. The wheel boss is 1 in. dia. with ½ in. bore × 3/32 in. keyway, finished dia. of wheel 5$\frac{15}{16}$ in. × ¾ in. and depth of rim ½ in.

Crankshaft was turned from solid flat bar, 1½ in. × ⅝ in., and finished 7 in. long × ½ in., with ⅞ in. throw and 3/32 in. keyway. The three



Left side, showing crankshaft bearing, governors, eccentric-rod, valve-chest, steam-valve and exhaust pipe



Right side, showing cylinder, slide-bars, driving pulley, built-up girders with safety guard for crank throw

main bearings are all split housing and phosphor-bronze bearings fitted complete with oil-cups. Slide bars were made from 1 in. × $\frac{5}{8}$ in. flat mild-steel bar and completed with oil-cups.

The connecting-rod was turned from 1 in. × $\frac{1}{2}$ in. flat bar and fitted with bronzes for big-end and small-end. Next came crosshead from solid bar and fitted with bronze bushes and floating connecting-pin. Piston-rod was made from 15/64 in. silver-steel and fitted with taper into crosshead and secured by $\frac{1}{16}$-in. taper pin.

The cylinder, for which I made a wood pattern and had cast in gunmetal, is finished 1 in. bore × $1\frac{3}{4}$ in. stroke, with drain-cocks at each end. I cut the ports $\frac{1}{8}$ in. × $\frac{1}{2}$ in. for inlet and $\frac{1}{4}$ in. × $\frac{1}{2}$ in. for exhaust. End covers were made with round gland of bronze on front cover, secured by through stud bolts, and finally fitted to cylinder with six stud bolts at either end. Steam chest is from bronze alloy with bronze D-valve and cover fixed with six studs.

The eccentric-rod, eccentric and strap were made with adjuster on the rod. The governor is driven by a small belt and the bevel-gears I got from an old disused air drill; the balls are out of an old ball-race from my motor-cycle. These I softened so that I could drill and tap them, and then steam pipes and valve were fitted together with hand-rail and notice-board.

Finally, came the hour to test out the result of many hours of work; so, having a Winco compressor, I tried it out on air. I got an air pressure of 50 lb. and then came the moment to open the valve, hoping something would happen! Yes, it did! She went beautifully; ticked over like a clock and when the valve was opened up a bit she would roar away like a lion. The power she develops is amazing; at 50 lb. you cannot hold the driving pulley.

So now the only thing I need for her is a displacement oiler and when I get this, the greatest moment will come because she will go over to the real thing—*steam.* I would just like to add that my free-lance mill engine has taken my grand-daughter's name and is called the *Janice.*

The Malden Gala Again

The Malden and District Society of Model Engineers evidently believes in taking Time by the forelock, since we have already received notice announcing a gala and exhibition to be held at the society's headquarters at Thames Ditton, on Saturday, Sunday and Monday, May 31st, June 1st and 2nd next, i.e. the Whitsun week-end. The exhibition will include a section open to model engineers all over the country, and the awards will be the Malden Medal of Merit, the Malden Championship Cup and a number of diplomas. Entry forms can be obtained from the Exhibition Manager, Mr. S. W. Stevens-Stratten, 3, Coombe Gardens, New Malden, Surrey.

This is always a most enjoyable event, and we hope that the number of entries will be at least equal to those of previous years. The society's fine continuous track will be in operation and there will be numerous side-shows.

Twist Drill Point Grinding in the Smaller Sizes

by W. D. Arnot

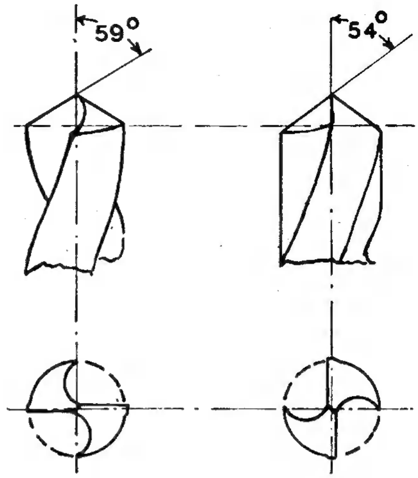


Fig. 1 *Fig.* 2

A SERIES of letters and articles on this subject in THE MODEL ENGINEER some time ago, aroused my interest. This led to my criticism of the results to be expected from the device Mr. Campbell described in the issue for November 16th, 1950, and which the editor did me the favour of publishing under Practical Letters January 18th, 1951. Here let me say regarding a reply by Mr. Campbell in a later issue, my purpose in writing was not to criticise destructively—indeed, I commend his initiative, for I had not even constructed a compromise device, though very conscious of its need—nor to browbeat with conics for I have not the knowledge, but to invite enlightenment.

THE MODEL ENGINEER did not fail me, for it certainly advanced my knowledge of this subject, in particular through the article by L. A. Van Royen, in the August 14th, 1913 issue to which Mr. S. W. Carr called readers' attention by his letter in the March 8th, 1951 issue, supplemented by Col. H. S. King's article in the issue for October 27th, 1927, which Mr. F. Krienke mentioned in his letter May 17th, 1951.

After studying this information and existing devices on the market, I came to the conclusion that to obtain perfect and theoretically correct results, all the refinements of the device Van Royen describes are needed, but that marketed devices in general strike a compromise to produce an article of lower cost.

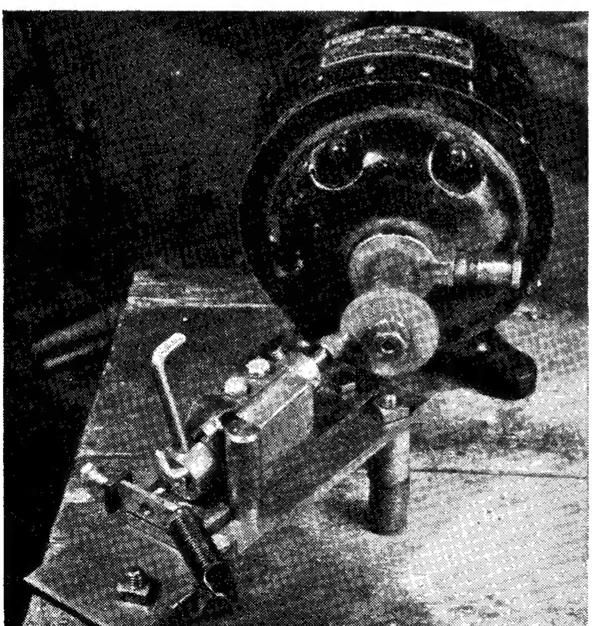
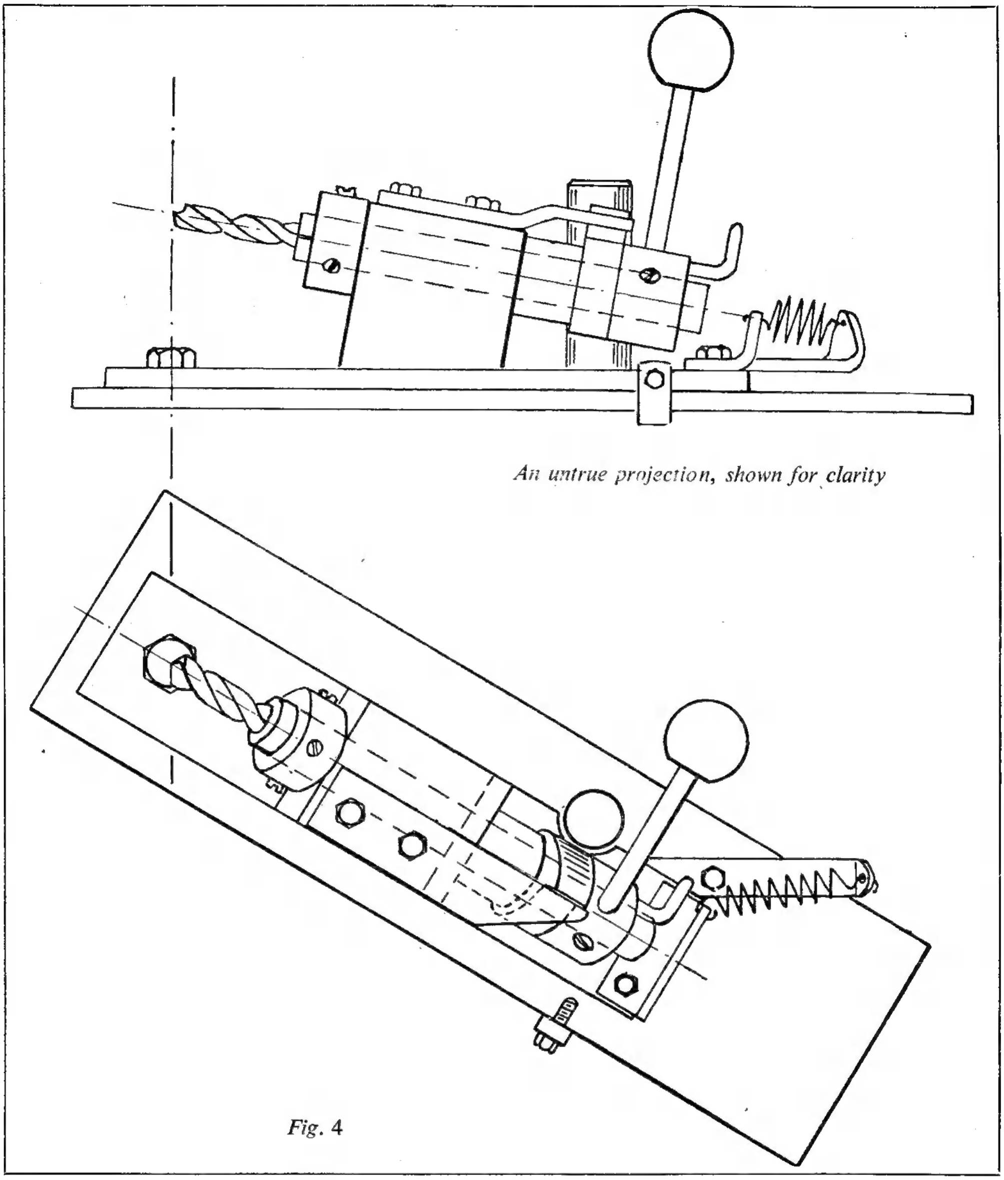


Fig. 3. *Showing a* 7/32-*in. drill mounted*

Following Van Royen, it appears that, measured from the wheel face, the drill should swivel on an axis of 13 deg. to it, and be supported in its rest at 59 deg. to the wheel. Where these two axes cross along the centre-line of the drill should be three drill diameters distant from the apex of the 13 deg. angle. Also, the drill axis should be offset laterally one-thirteenth of its diameter, towards direction of swivel.

Now, a fitting supplied by Wolf Electric Tools Ltd., for attachment to their bench grinders, for use with drills from $\frac{3}{8}$ in. to 1 in. diameter, appears to conform to these measurements, except that the lateral offset does not appear to be variable. On the other hand, a successful device, the "Reliance" drill jig made by H. D. Murray Ltd., of Ponders End, appears to provide quite different angles. It seems to be set to a swing axis of some 35 deg. and rest axis of 59 deg. with a drill axis to swing cone apex setting of about one drill diameter. These are values derived from observation and not the maker's claim.

These conclusions are very puzzling to one who does not know the fundamental requirements, and the inference is that all existing jigs are successful compromises within practical requirements.



An untrue projection, shown for clarity

Fig. 4

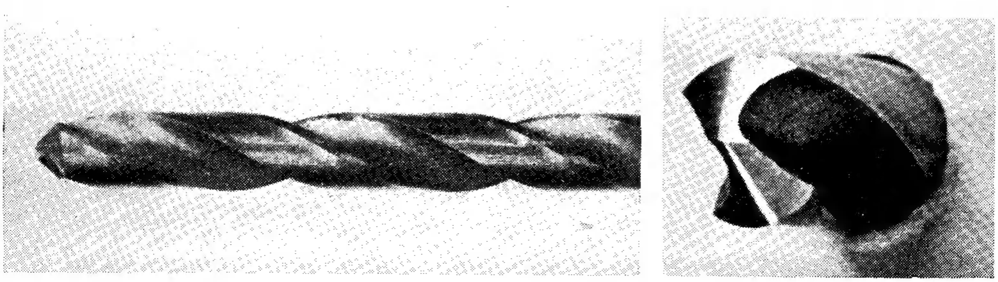


Fig. 5. Views showing the relief and point of a 7/32-in. drill

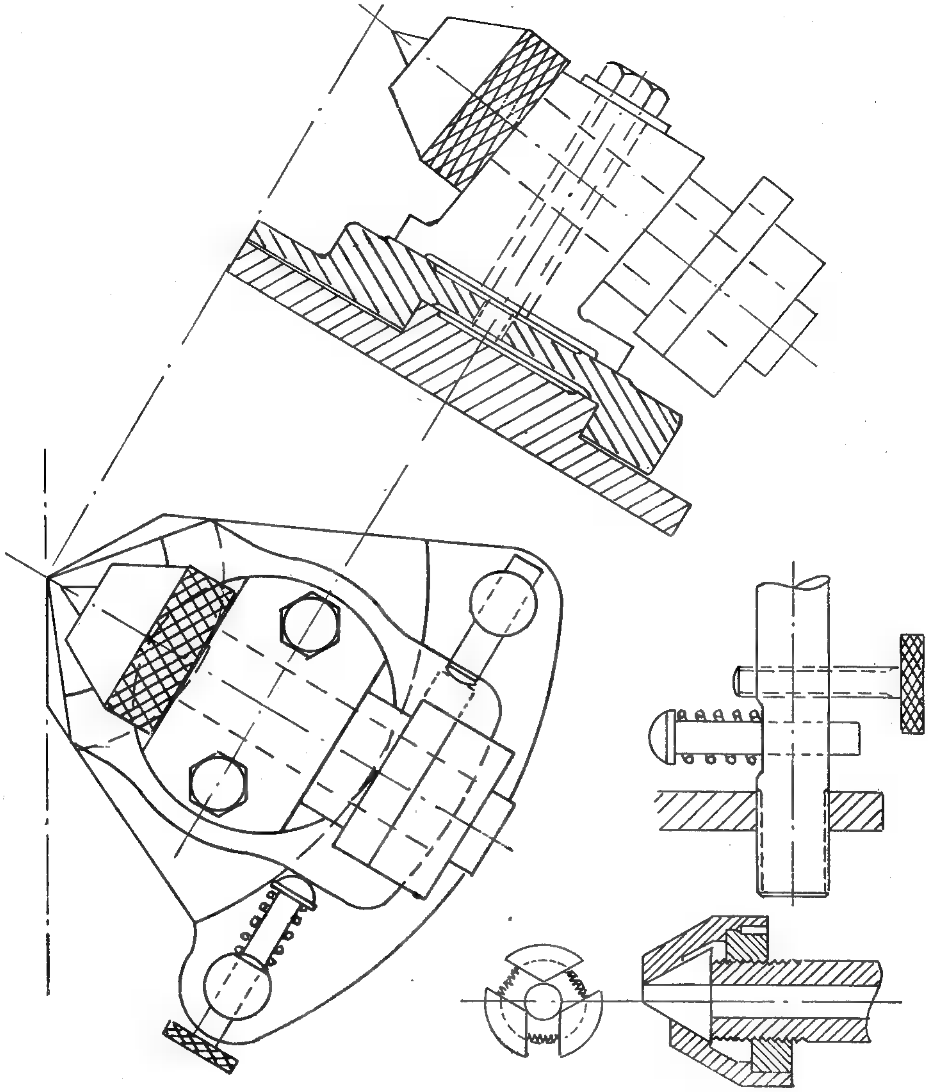


Fig. 6

Now, none of these devices appears to cater for drills less than $\frac{1}{8}$ in. diameter and I [redacted] anxious to deal with drills as low [redacted] possible, or high in number, in the range of number-size drills. Also, I want [redacted] device that can be built simply, with a wide range of capacity.

After several attempts to imitate the standard drill grinding jig on a smaller scale, I changed my front and produced [redacted] device with considerable success. This description is a sort of interim report [redacted] others may be interested and able to suggest means of perfecting results.

The line of thought has been this: If you examine [redacted] machine-ground drill point, you find the cutting edge at 59 deg. to the drill axis (Fig. 1). If you revolve it 90 deg. and take the corresponding angle, it is about 54 deg. (Fig. 2). What is wanted, then, is a [redacted] of presenting the drill to the wheel on [redacted] horizontal axis (with 10 deg. tip to give cutting clearance) at 59 deg. to the wheel, and [redacted] of swinging this angle to 54 deg. in about one quarter turn of the drill on its axis; the two movements to be synchronised.

A device which does that is shown in the photograph (Fig. 3), and by the drawing (Fig. 4). The result it has given on [redacted] 7/32-in. drill [redacted] be seen in the two photographs (Fig. 5).

The device is used as follows: It is fixed [redacted]

that the face of the grinding wheel lies above [redacted] line scribed [redacted] the baseplate, in which position the drill axis lies [redacted] 59 deg. to the wheel. The centre round which the drill is swung is arranged to lie on the wheel face, i.e. in the plane of the wheel face. The drill is secured in its holder by the front collar with grub-screws which close the slotted front end on it. The point is [redacted] fraction clear of the wheel. Behind the bearing block is [redacted] spacing sleeve on the drill holder, then the cam, also free, then [redacted] operating collar which [redacted] be locked to the drill holder by grub-screw. This collar is drilled at diametrically opposite stations in its face. A pin fits these drillings and passes through a single drilling in the cam. Two radial drillings are also provided to take the tommy bar or operating lever.

When the drill is to be ground, it is pushed up to the standing wheel, the spacing collar brought back the amount to be ground away, the cam brought up to it, the locking collar against the cam and the grub-screw used to secure it. The pin is now put in one of the holes of the collar and passed into the hole in the cam.

Before the drill is clamped by the front collar, it is now revolved to bring [redacted] cutting edge horizontal and then locked in that position. Withdraw clear of the wheel and start up. By [redacted] single movement the drill is now advanced to cut and also revolved by the tommy bar, the cam compelling the holder to swing from 59 deg. to 54 deg. This action is repeated until the spacing collar prevents any further advance and cutting ceases. Withdraw and remove the pin locking the cam to the rear collar and revolve the drill holder until the pin can be inserted through the diametrically opposite hole. This brings the unground lip to the same grinding position. Grinding is repeated as before until the spacing collar arrests advance and cutting stops.

It is evident that both cutting angles are alike, that the lips must be of equal length, that the relief is identical for both lips. In short, the whole result should be true and symmetrical.

The 7/32-in. drill is shown to get [redacted] large enough illustration, but I have also ground [redacted] $\frac{1}{16}$-in. drill in the same way, and under the glass it looks equally good. The smaller drill was held in [redacted] pin-chuck having a 7/32-in. shank, with only about $\frac{1}{16}$ in. of the drill point projecting from the chuck.

Now, that is all very well for [redacted] grinding wheel small enough to get the swing centre beneath. But most grinding wheels are larger and it is desirable to have [redacted] tool to fit any wheel. With that object in view I have drawn up designs for [redacted] development of this device on the lines of Fig. 6. This model demands patterns and castings, which for the present I am having made in aluminium because of ease of supply. I should expect equally good results from this model if carefully made, and if there should be a number of readers interested, I shall be glad to report results. Moreover, if it is [redacted] complete success and other readers [redacted] interested in using the castings, I [redacted] ready to make arrangements to supply them from my patterns. They will, of course, first want to hear results but early mention of their interest would allow me to make tentative arrangements.

There is one detail of this design that is rather tricky; that is the chuck. I would like to have used collets, but the Eclipse collet-holders are not bored through, and I know of none with the range required that are. Perhaps readers can suggest [redacted] commercially available device that would not be too costly.

"Circumstances Alter Cases"

This is [redacted] well-known saying which seems to apply to nearly everything we [redacted] see, hear or touch in the [redacted] of our everyday lives; but it occurred to the editorial mind immediately while we were reading [redacted] letter recently received from [redacted] overseas reader. The letter dealt with [redacted] very technical and theoretical subject, namely, the very poor showing which the steam locomotive makes when compared with a motor-cycle, so far as the ratio of weight to power is concerned.

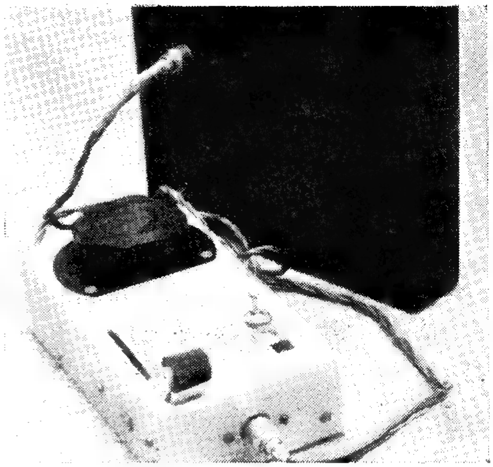
Our correspondent pointed out that [redacted] modern express passenger steam locomotive weighing about 150 tons is capable of developing 1,500 horsepower, which gives [redacted] weight/power ratio of 224 lb. per horsepower, whereas [redacted] motor-cycle weighing some 200 lb. and developing about 10 horsepower gives [redacted] ratio of only 20 lb. per horsepower and is, in consequence, a far more efficient machine.

We [redacted] prepared to agree with [redacted] correspondent's figures, so far [redacted] they go, in spite of the fact that we believe his estimates to be below the maximum in the [redacted] of the locomotive and high in the case of the motor-cycle; but that is by the way. To our way of thinking, the comparison put forward by our correspondent is useless and actually fallacious, since it takes no account whatever of the circumstances in which either of the machines is working. The locomotive, when developing 1,500 h.p. would probably be hauling a 500-ton train at—on level track—75 m.p.h. or more; [redacted] motor-cycle at the same speed, and on [redacted] level road, would be hauling, at the most, two people weighing together about 280 lb. or one-eighth of a ton. But even this is not the true picture, because the *total* weight being moved is 650 *tons* by the locomotive and 400 *pounds* by the motor-cycle; it is thus quite clear that the weight being moved per horsepower is far greater in the case of the locomotive, and therefore the ratio of weight to power alone cannot be regarded [redacted] any sort of indication of the efficiency of [redacted] machine. Only [redacted] full consideration of all the circumstances affecting the machine's performance at any moment [redacted] be of any use at all in arriving at an estimate of its capabilities or of its suitability for any given purpose.

A Radio-Control System

With the help of which you can widen the scope of your existing apparatus

by R. S.



MODELLERS who prefer the mechanical approach to radio control rather than the electronic, may be interested in the system described which was recently developed for a 1 in. scale motor cruiser.

Although designed complete with its radio gear, the idea is, quite fortuitously, capable of being exploited in the form of add-on units to virtually any home-made or commercial radio apparatus; it might, therefore, be used by anyone currently operating a simple sequential system of control. Some of the advantages of a multi-channel system are incorporated, without the electronic complication.

As designed, the equipment gives selective control of port or starboard rudder in 3 deg. steps either way, about four seconds being required to change from Port 30 to Starboard 30. In addition, a further "channel" is available for engine control.

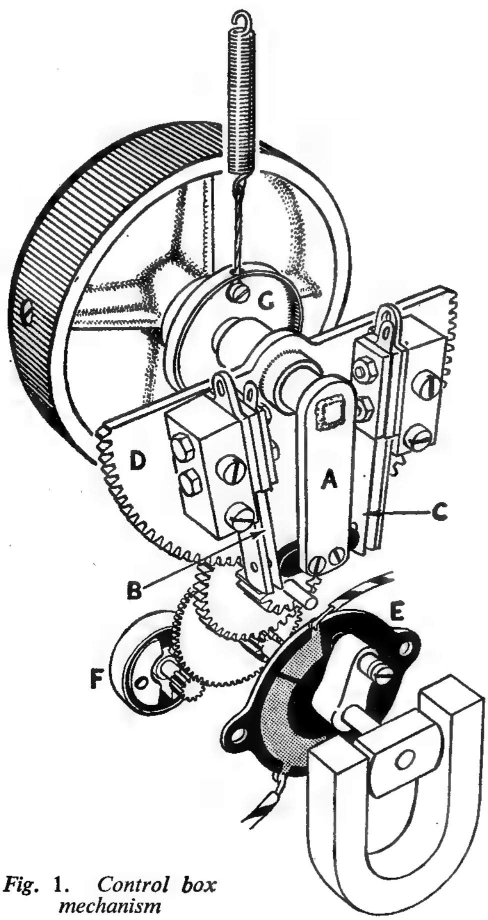


Fig. 1. Control box mechanism

Principle

The radio transmitter and receiver are quite standard in design and operation and are not critical—either a modulated or non-modulated carrier may be used, since all that is required is an apparatus that will close a pair of relay contacts in the model whenever the transmitter H.T. is keyed.

The additional units required are a **control box** (integral with or plugged into the transmitter) and a **steering unit** following the receiver.

The function of the control box is to translate control movements into the required number of short or long pulses. Short pulses correspond to port-going signals and long pulses to starboard-going signals, thus introducing an element of *quality* into the transmissions: a degree of *quantity* is introduced by the number of either type of pulse sent, and this factor is determined by the extent of control movement applied.

The function of the steering unit is to convert the incoming pulses into the appropriate steering movements, differentiating between long and short pulses. An additional mechanism which responds only to very long pulses is used to give a sequential control of engine speeds.

Control Box

The external appearance is shown in the photograph, and the size is $7\frac{1}{2}$ in. by 4 in. by 2 in. deep, though these dimensions could be reduced considerably if necessary.

Fig. 1 shows the arrangement of mechanism inside, the operation being as follows:—

Initial movement of the steering knob in either direction causes lever **A** to close one of the two "sense" switches, **B** and **C**, which are mounted on the segment plate. Continued rotation of the steering control transfers torque through the closed switch to the toothed segment **D** thus driving the gear train which has a ratio of 40 to 1. The final shaft in the train carries a carbon brush rotating against an insulating disc **E** provided with two copper inserts. These inserts are connected to the two "sense" switches above, so that only one is in circuit at a time (dependent upon which way the knob was originally turned).

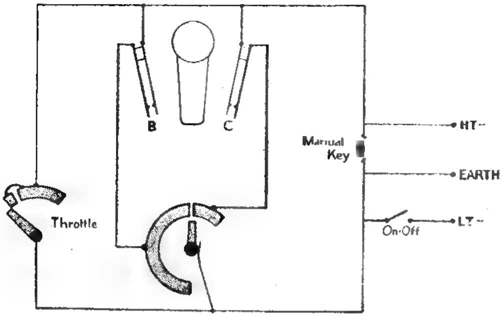


Fig. 2. Control box circuit

The two inserts are of different circumferential lengths and there is a blank insulating section between them on one side. Thus, as the brush rotates over the disc it completes an electrical circuit once every revolution and in doing so it keys the transmitter. Fig. 2 shows the circuit and it will be evident that the length of the pulses transmitted will depend upon which segment is selected by the sense switches, i.e. which way the knob is turned.

The above reasoning assumes that the knob is rotated at an invariable speed, which might apply if it were turned by a servo motor following the movement of a manual control. Such an arrangement would be ideal for providing accurately metered pulses, but is rather complicated and requires additional battery power. A speed limiting device is, therefore, fitted in the form of a simple centrifugal governor (**F** in Fig. 1) and this exercises a powerful braking action above a certain speed, thus preventing "long" pulses becoming so short that they are interpreted as short transmissions at the steering unit. No provision is made for preventing the reverse happening, i.e. "short" pulses becoming sufficiently slow to be interpreted as long; but it is found that the natural tendency is in any case to over-steer too violently, and no trouble has been experienced for this reason.

To improve the "feel" of the controls, the steering shaft is provided with a drum **G** carrying a spring-loaded wire which centres the knob when it is released.

In order to prevent the transmission of a spurious signal when the knob is initially rotated—which might happen if the brush stopped on one of the segments—a small bar-magnet is fitted to the brush gear shaft. This rotates between the poles of a horseshoe magnet and stops naturally in one position only, which is arranged to be where the brush is resting upon the insulating section.

The other components of the control box, seen in the photograph, are an on-off switch for the transmitter L.T. supply, a micro-switch acting as a manual control for keying the transmitter if the automatic mechanism becomes out of phase, and a throttle lever, described later.

Steering Unit

Fig. 3 shows the arrangement of the parts. **A** and **B** are two electromagnets which are fed from a local 6-volt power supply *via* the secondary contacts of the receiver relay. The circuit supplying **B**, however, incorporates a delay device, with such a time lag that whereas **A** responds to both short and long pulses, **B** operates only when long pulses are received.

Each electromagnet has a pivoted armature carrying a pawl, the latter resting upon a ratchet toothed wheel mounted loosely upon the central steering shaft **C**. Fixed to the ratchet wheels are two bevel gears forming the driving members of a differential. A pair of bevel pinions between these gears are carried on a cross-shaft rigidly attached to the steering shaft.

The two ratchet wheels are turned by their electromagnets in opposite directions, so that

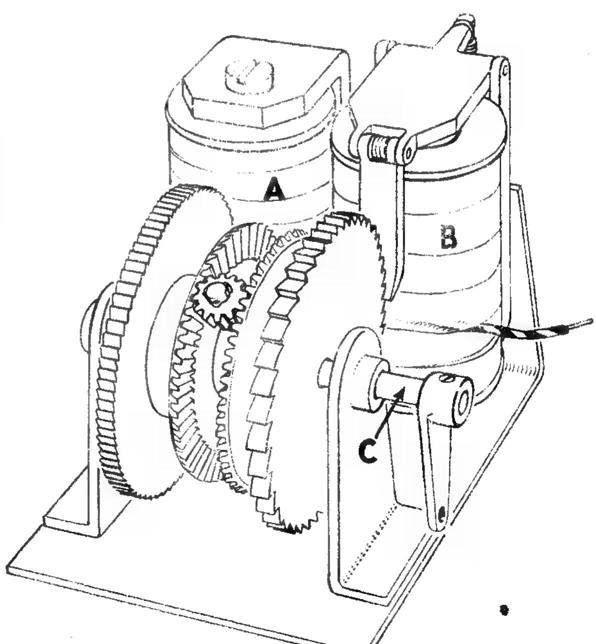


Fig. 3. Steering unit

the final movement of **C** depends upon the algebraic sum of the movements of both ratchet wheels—in fact, the usual differential action.

When short pulses are received, magnet **A** (only) operates, and advances its wheel by one tooth: there are 100 teeth on this wheel so the

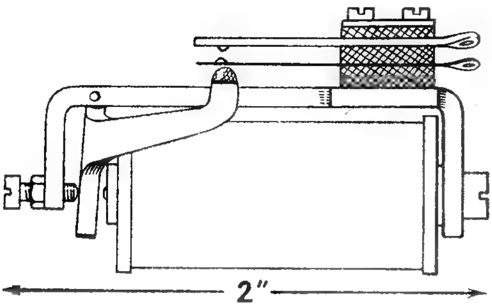


Fig. 4. Delay relay

advance is 3.6 deg. per pulse. The steering shaft advances (through the differential) 1.8 deg. per pulse.

When long pulses are received, magnet **B** operates as well as magnet **A** but the wheel operated by **B** has 50 teeth; consequently the half of the differential associated with **B** advances 7.2 deg. per pulse. Thus the steering shaft advances 1.8 deg. per pulse as before, *but in the opposite direction.*

The drop arm on the steering shaft is connected by a push-pull rod with the rudder head in such a way that 10 pulses in either direction serve to shift the helm from amidships to hard over (30 deg.).

In order to provide a time lag in the operation of electromagnet **B** (the starboard-going unit) various methods might be used depending on the delay required. In this case a working speed of 4 sec. from Port 30 deg. to Starboard 30 deg. was decided upon, and increments of 3 deg. were considered adequate for fine rudder control —this latter factor depends, of course, on the speed of the model. Twenty pulses would, therefore, be required to go from hard a'port to hard a'starboard so that the speed of working is 5 pulses per second, a very conservative

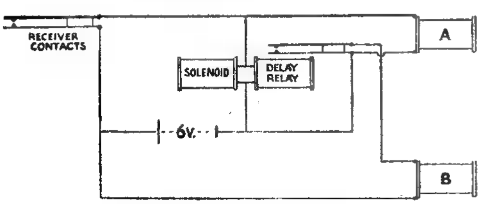


Fig. 5. Circuit in model

rating for simple electromagnetic equipment. The ratio between short and long pulses was made 4:1 with an interval equal to 3 units—thus a short pulse occupied $\frac{1}{8}$ of 1/5 sec.; and a long pulse took 4/8 of 1/5 sec. or 1/10 sec.

The time delay mechanism had, therefore, to discriminate against a 1/40 sec. pulse, but accept a 1/10 sec. pulse. This is quite a short delay and orthodox methods such as a "slugged" relay were unnecessary. Eventually I used a home-made relay of quite conventional design (Fig. 4) which just operated with a 1/15 sec. pulse, the mass of the armature and its gap being adjusted to obtain this value. It is this relay, wired simply into the circuit, which provides the delay action (as shown in Fig. 5).

The construction of the steering unit is straightforward and follows Fig. 3 closely. The complete mechanism has been sealed into a water-tight case for obvious reasons, the wires entering through rubber bushes. No trouble has so far been experienced with it, and I consider any system using simple electromagnets such as this to be most reliable, as there is no trouble with

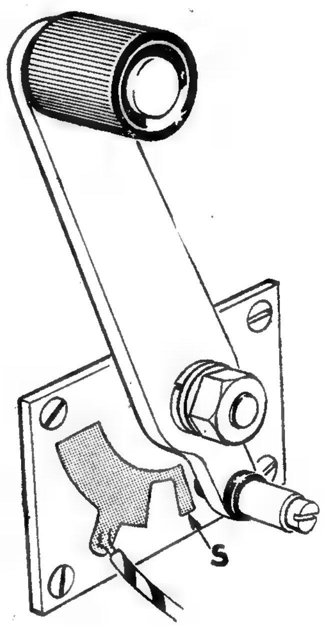


Fig. 6. "Throttle" lever

brush-gear or the possibility of non-starting, such as may occur with motors.

Furthermore, the employment of even large pulses of current is kinder to dry batteries than the continuous drain of motors.

Engine Control

It was considered desirable to be able at least to provide control over forward movement of this model, and having had some previous experience of servo-operated gearboxes and clutches, I decided to try a different method.

The motor being a water-cooled petrol engine, I fitted a second contact-breaker driven from the auxiliary drive shaft—the latter was already there to operate fuel and water pumps.

The supplementary contact-breaker was set

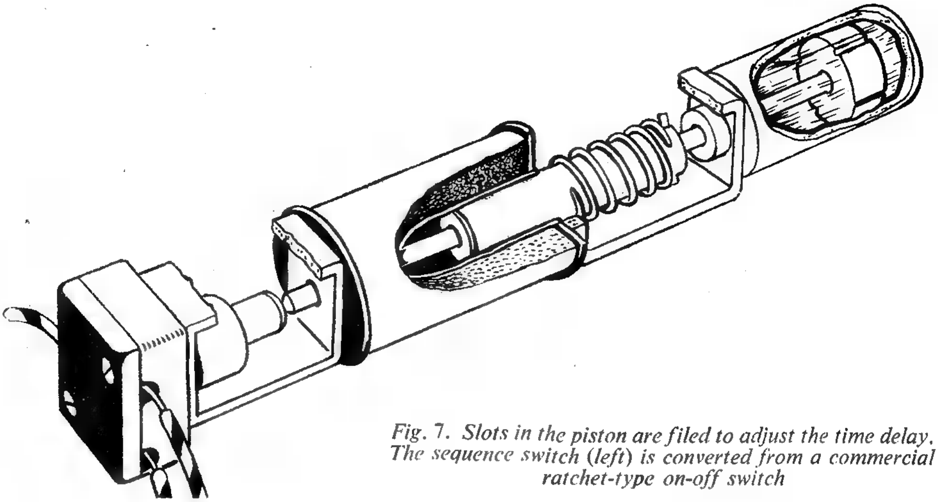


Fig. 7. Slots in the piston are filed to adjust the time delay. The sequence switch (left) is converted from a commercial ratchet-type on-off switch

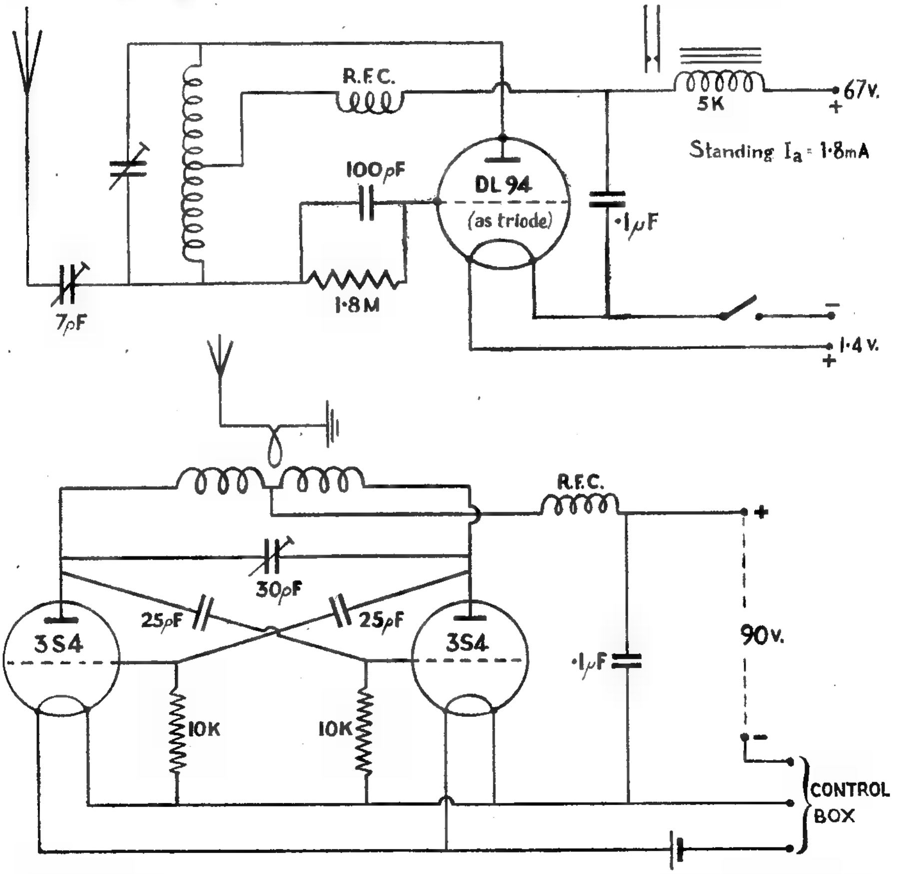


Fig. 8. Receiver and transmitter. Receiver : Coil is seven turns 16-g. tinned copper, 0.6 in. i.d., 1 in. long. Tuning condenser 2 × 15-25 ceramic rotary trimmers in parallel. Transmitter coil is ten turns 16-g. 0.75 in. o.d. double spaced and opened in the centre to receive the aerial coil

for idling speed (the main one being adjusted for maximum revs.) and a centrifugal clutch was fitted to the flywheel. By switching electrically between the two contact-breakers, the forward movement of the model could thus be controlled.

The throttle lever in the control box is no more complicated than Fig. 6 indicates—a brush on the lever simply passes over a long segmental contact while the lever is being shifted in either direction. This transmits a long pulse—roughly ½ sec. with average use of the control—and this is sufficient to permit a solenoid in the engine-room of the model to complete its stroke. The natural exuberance of the solenoid is restrained by a simple oil-filled dash-pot, so that at least a ¼ sec. pulse is required to work it. Fig. 7 shows the details; movement of the solenoid plunger operates a two-way sequential switch as shown, and this is used to switch between the two contact-breakers.

It will be realised that transmission of this long pulse also provides a spurious "starboard-going" signal. This may be countered by accompanying any throttle movement by a very short manual pulse on the microswitch; but automatic compensation has been attempted by fitting the very short segment **S** in Fig. 6 at the beginning of the main contact. This is intended to give a short port-going pulse before the additional and unavoidable starboard signal. It is, to be honest, not always successful and, if the throttle is moved too slowly, may make matters worse by doubling the error. This is not, however, any great practical drawback to the system as a whole.

General

The radio system, as stated earlier, is not important as to design, but the circuits of both ends are shown in Fig. 8, for the record. The receiver is a very useful one for any system, as it is surprisingly sensitive for such an orthodox arrangement. Fig. 9 indicates the physical layout.

It is important to use the valve noted and not any "rough equivalent" type, and one of the features of the design is the ratio between L/C in the tuning circuit. The correct operation of the gear requires **C** to be set rather critically—**C** also partly determines the standing anode current —and tuning should be carried out (except perhaps for the last fine adjustment) by pinching the turns of the coil together, or spreading them, as necessary. The ceramic type of condenser seems to be ideal in the tuning circuit, and an air-spaced one of equivalent capacity gives disappointing results.

The mechanical system utilising pulses of varying lengths, described above, was an original design, since I have not seen a similar idea described. It seems, however, an obvious way of increasing the utility of a single frequency system, and probably other readers have experimented along similar lines; if so, it would be interesting to know the results obtained.

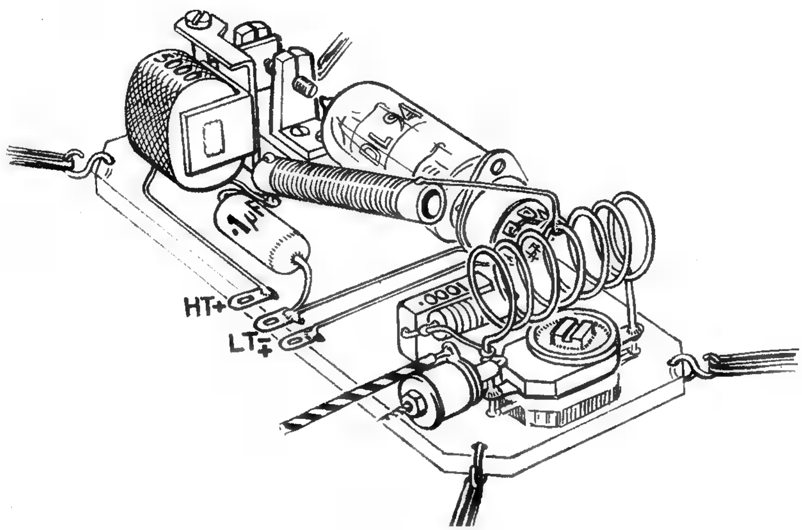


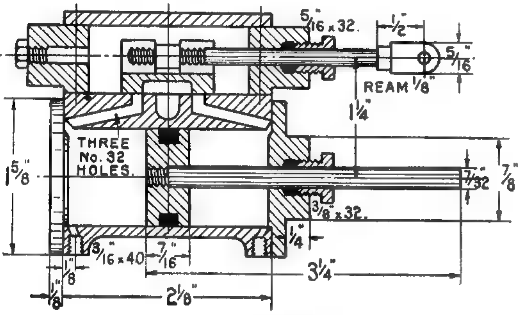
Fig. 9. Receiver. The components are mounted on a Perspex panel

"JULIET" WITH OUTSIDE VALVE GEAR

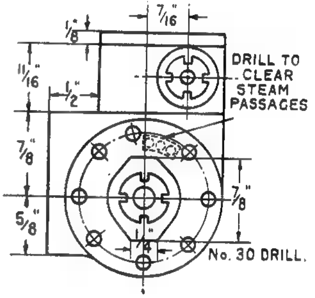
by "L.B.S.C."

Cylinder Construction

As promised three weeks ago, here are the drawings and some detail notes about the cylinders for *Juliet No.* 2 with outside valve-gear. As you'll see, they are really an enlarged version of those I specified for *Tich*, and differ from those that I specified for the original *Juliet* in having the valves on top, to suit the outside valve-gear. The bore and stroke remain the same, viz. 1 in. × 1½ in., and I have kept to the same size of steam and exhaust ports, and passageways. This allows of a steam-chest much the same as the original, and saves metal, which is a very important consideration in these crazy days of "first priority for bloodshed-and-destruction." Incidentally, my most fervent prayer is that the opening sentences of my Christmas tale may come to pass! By the time these notes appear in print, or very soon after, castings for the cylinders may be available from our approved advertisers. Making them up is a plain straightforward job; nothing to cause any kind of difficulty, nor require extra care. They will also do for other types of moderate-sized locomotives; for example, the "class 2" 2-6-0 tender engines and 2-6-2 tank engines of the last L.M.S. design, which British Railways will continue to build for moderately light cross-country traffic, and other purposes where a medium-sized modern engine will fill the bill in the most efficient manner. I have already given fully detailed instructions in the recent *Tich* serial, for machining up this type of cylinder, so a brief resumé should enable anybody with the average amount of gumption, to make a first-class job; very few of our readers lack their share of *that* essential commodity!



Section of cylinder



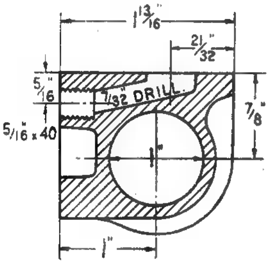
Back end of R.H. cylinder

Cylinder Bodies

The cylinder blocks can be machined on an angle-plate attached to the faceplate. If the centre of the core-hole is not less than 1 1/16 in. from the bolting face, and not less than 15/16 in. from the port-face, there is no need to do any marking-out. Just mount the casting on the angle-plate, port-face down, securing with a bar across its back, held down by a bolt at each end. If there are any superfluous knobs and excrescences on the port-face, smooth them off first, with a file. To set the casting parallel with the lathe bed, use a try-square, stock against face-plate, and blade applied to bolting face; have the end of the casting overhanging the angle-plate by at least ⅛ in. Finally, adjust the angle-plate on the faceplate until the core-hole runs truly, and tighten the bolts. Face the end with a round-nose tool set crosswise in the rest, removing half the difference between length of casting, and the finished cylinder; then bore out in the usual manner, using the stiffest possible tool that will go through the core-hole. If the lathe has a self-act, use it with the finest feed that the change-wheels will allow; if not, use the top-slide, setting it to bore truly as described in the *Tich* notes. If a 1-in. parallel reamer is available, bore until the "lead" end will just enter; if not, bore to 1 in., and run the boring tool in and out, three or four times, without putting on any more cut. This will give an excellent finish, smooth and true. If reaming, either do it in the lathe, or by hand, with the casting held in the bench vice, as described for *Tich*.

The opposite end of each cylinder can be faced off by mounting the casting on a stub mandrel held in the three-jaw; whilst the port-faces and bolting faces can be trued with the casting mounted end-up on the angle-plate, secured with a bolt through the bore. Don't forget a soft metal washer, top and bottom, to protect the faced flanges. Set truly with a try-square, stock to faceplate, and blade to one of the flat-faces;

use a round-nose tool set crosswise, and slew casting around a quarter-turn to do the second face, setting the machined one to the try-square blade, as the faces must be at right-angles. The ports, if not cast in, can be end-milled, with the casting mounted on an angle-plate, end-up, in a manner somewhat similar to that mentioned above, the angle-plate being attached to a vertical slide. I prefer home-made slot drills (described in the *Tich* notes) for this job; they scoop out the metal faster and cleaner than commercial end-mills, and I don't have to remind you that they don't lighten your pocket to anything like the same amount! A few pence worth of silver-steel, plus a little common " savvy," does wonders—and your name doesn't have to be Ikenstein or MacTavish, to realise it to the full—vot you tink, eh? Hoots, mon, awa' wi' ye! Failing any means of machining, drill rows of holes, and cut them into rectangular ports with a small chisel made from a bit of silver-steel, same as young Curly did in the days of auld lang syne. They needn't be more than $\frac{1}{4}$ in. deep, in any case. Passageways can be drilled either by machine or hand, as described in the *Tich* notes, and don't

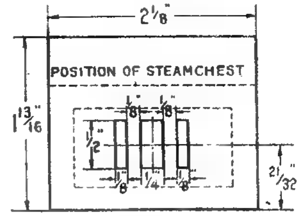


Section through exhaust port

forget the wheeze of grinding the drill a wee bit off-centre, so that it cuts an oversize hole, and if the drill breaks, the bits can be shaken out, and the casting saved. When drilling the exhaust passage, drill and tap the $\frac{5}{16}$ in. × 40 hole first, then run the 7/32-in. drill from the end of that, up into the port; see section through exhaust port. Aim the drill to run centrally between the cylinder bore and the port-face.

Covers, Piston and Rod

The covers should have the usual chucking-pieces on the outer side, so that they can be held in three-jaw, and the registers and contact flanges turned at the same setting. The registers on the back covers need to fit the bores without shake. Centre and drill down about $\frac{1}{2}$ in. depth with No. 2 drill, for the piston-rod. Turn the covers to $1\frac{5}{8}$ in. diameter. Part or saw off the chucking-pieces, and rechuck the other way around, holding either by the edge in three-jaw, or in an improvised step-chuck, as described for the *Tich* covers, to turn the outsides. Open up the gland boss with a pin-drill, for tapping, to ensure the gland will be true with the piston-rod. The part that cannot be turned, owing to the oval gland boss, must be carefully filed. The guide bar flats can be end-milled, if the cover is clamped or screwed to a piece of metal that can be held by the slide-rest tool-holder; or the cover can be attached to the vertical slide, if one is available, by a couple of dog cramps, same kind as those used for clamping work to the faceplate, only made in " OOO " gauge size. I frequently make little dog cramps for special jobs from odd bits of small steel rod from the oddments box at the back of my bench; steel pups! Drill the holes

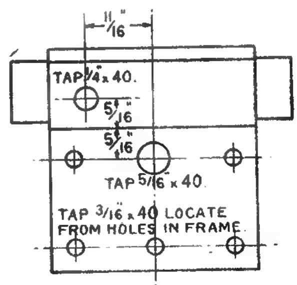


Port-face

for the cover screws as shown in the drawing: $\frac{1}{8}$ in. or 5-B.A. screws are used.

The glands are turned from $\frac{1}{2}$-in. round bronze rod; don't forget that the threads shouldn't be slack enough to allow the gland to work out when the engine is running at a tidy lick. Tip: drill the glands a shade under size, say with No. 4 drill; put them in place in the stuffing-boxes on the covers, and poke a 7/32-in. parallel reamer through the lot, turning the gland at the same time. This will prevent any binding of the piston-rod, no matter what position the gland takes up.

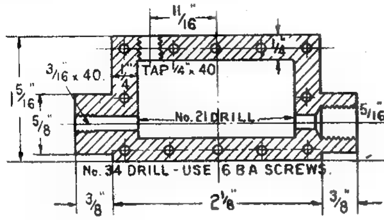
Cut the piston-rods to length, and screw them with a die in the tailstock holder. Use rustless steel if available; failing that, hard bronze, either nickel (German silver) or phosphor. Don't use ordinary steel, unless as a last resource. As to the pistons, I usually make mine from either drawn bronze, or cast material of a different grade to the metal used for the cylinder castings; but I have also obtained excellent results from the metal used for alloy automobile pistons (scrap pistons melted down and cast into a stick) rustless



Bolting face of R.H. cylinder

steel, and dural. Anyway, at the present time, it is a case of using whatever is available! Rough-turn the two pistons at one go, with the metal held in the three-jaw, turning them to 1/64 in. oversize, or thereabouts; centre and drill each $\frac{3}{16}$ in. before parting off. Then chuck each rough piston in three-jaw, open out half the depth of the hole with No. 3 drill, and tap the rest 7/32 in. × 40.

Put ■ piston-rod in the tailstock chuck, screwed end outwards, run it up to the piston in the three-jaw, enter the threaded portion in the hole, and pull the lathe belt by hand until the piston-rod is right home. The pistons are finish-turned to ■■ exact sliding fit in the cylinder bores, with the piston-rod either gripped in ■ collet chuck, or in a split bush held in three-jaw. Fully detailed

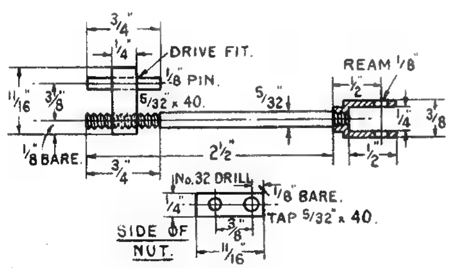


Section of steam-chest

instructions for piston finishing were given in the notes on machining up *Tich* cylinders. Incidentally, arrangements are now being made by "our firm" to publish the whole of the *Tich* articles as a companion book to the *Live Steam Book*, and the one now in the press about *Maisie*. This will include all the supplementary notes and illustrations, as well as the construction of the driving car, so should be ■ great help to new readers who are just taking up locomotive building, as it "shoots the whole works" from A to Z. Any raw recruit who doesn't even know what pushes the piston up and down the cylinder—or even doesn't know what pistons and cylinders are !—can build and drive his own small locomotive, simply by following the "words and music." Hundreds have already done so, and very successfully, by following the "serial" articles.

Steam-Chests

The steam-chests are similar to both the original *Juliet* and *Tich*. The way I machine up the casting, is to grip one boss in the three-jaw, and set the other one to run truly ; a few judicious

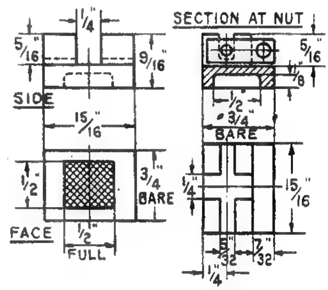


Valve spindle and nut

taps with a lead or "bacon-rind" (hide-faced) hammer soon does the needful. That end is then centred with ■ Slocomb drill, and the centre point of the tailstock entered into it for support, whilst the outside of the boss is turned, and the end of it, also the casting, faced off. The tailstock is then run back, the drill chuck put in it, and the boss drilled No. 21 or 5/32 in. Carefully face off the little pip left around the centre hole, then tap $\frac{3}{16}$ in. × 40 for a little way down. Reverse the casting end for end, and ditto repeato operations ; but this time, open out the small hole to ■ depth of $\frac{3}{8}$ in. with ■ 7-mm. or letter J drill, and tap $\frac{5}{16}$ in. × 32. The two longer sides of the steam-chest can be cleaned up with ■ file, and the contact faces are easily machined off with the casting held in the four-jaw, using ■ round-nose tool set crosswise in the rest.

Set out and drill the screw-holes as shown in the illustration, and drill and tap the hole for the steampipe. Warning—don't forget you'll need one right-hand and one left-hand steam-chest, so drill the steampipe holes accordingly. The steam-chest can then be temporarily clamped in place on the cylinder port-face, and countersinks made on the port-face by putting the No. 34 drill down the holes in the steam-chest walls. Remove chest, drill the countersinks No. 44 and tap 6 B.A.

The steam-chest cover is ■ bit of brass plate $\frac{1}{8}$ in. thick, measuring $1\frac{5}{16}$ in. × $2\frac{1}{8}$ in. Drill it by clamping it to the steam-chest and running a No. 34 drill through the lot. Smooth off the port-



Slide valve

face, and contact faces of steam-chest and cover, by the well-tried wheeze of rubbing them on ■ sheet of fine emery-cloth or similar abrasive, laid with its business side up, on the lathe bed, surface plate or some other true surface. A dozen 6-B.A. screws (any heads you fancy, or as may be available) will do for fixing the lot together ; or studs may be made from 7/64-in. round mild-steel. The spindle gland is just a smaller edition of the piston gland, made and fitted same way ; whilst the $\frac{3}{16}$ in. tapped hole in the front boss is plugged with a $\frac{3}{16}$ in. cap made from $\frac{1}{4}$ in. hexagon brass rod, as shown in the sectional illustrations.

Slide Valve and Spindle

Owing to the offset of the valve spindles, it is necessary to drive the slide valves from one side of the steam-chest ; but this is easily done by the arrangement shown in the drawing. A step is cut along one side of the valve, to accommodate the valve spindle. The back of the valve is cross-slotted to take the usual driving nut carried on the screwed part of the spindle. To prevent lateral movement of the valve, a pin is fitted to the driving nut, and ■ groove cut in the valve, in which the pin works, so that side movement

is limited to the amount of sideplay which the pin has in the groove.

Each valve requires a block of metal $\frac{3}{4}$ in. wide, $\frac{9}{16}$ in. high and $\frac{15}{16}$ in. long. Castings may be used, or the valves made from bar material; gunmetal, bronze, or the piston alloy as mentioned above. If a milling machine isn't available, the grooves for the nut and check pin can be end-milled in the lathe, by clamping the valve on its side or end, according to which groove is being formed, and traversing across an end-mill or slot-drill held in the three-jaw. The process is the same as described for milling the channels in the sides of axleboxes. Alternatively, the valve can be held in a machine-vice, regular or improvised, bolted to the lathe saddle, and traversed under an ordinary milling-cutter (side-and-face) mounted on an arbor between centres. The cavity for the exhaust steam may be end-milled out, if a vertical slide is available; otherwise it may be formed by first drilling a few countersinks over the location of the cavity, and chipping them into the correct shape and size, with a small chisel, home-made from a bit of $\frac{1}{4}$ in. silver-steel.

The 5/32 in. valve spindles should be made of the same material specified for piston-rods, and each is a wee bit under $2\frac{3}{4}$ in. long. One end is threaded 5/32 in. × 40 for $\frac{3}{4}$ in. length, and the other $\frac{3}{16}$ in. The short end carries the fork or clevis for attachment to the combination lever, the fork being made from $\frac{5}{16}$ in. × $\frac{3}{8}$ in. steel, or $\frac{3}{8}$ in. square would do. I have described how to make valve-gear forks umpteen times, so further repetition is unnecessary in this case. Note the extra width of jaw; this embraces both the top of the combination lever (to be described with the valve-gear) and the radius-rod.

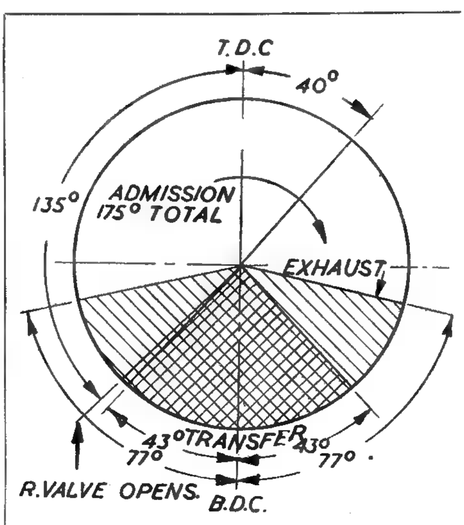
The nut is an $\frac{11}{16}$ in. length of $\frac{1}{4}$ in. square brass rod. At a bare $\frac{1}{8}$ in. from one end, drill a No. 30 hole and tap it 5/32 in. × 40. At $\frac{3}{8}$ in. farther along, drill a No. 32 hole, and squeeze a $\frac{3}{4}$ in. length of $\frac{1}{8}$ in. rustless steel or bronze rod into it. The assembly is shown in the illustration. All that then remains to be done, is to put the whole bag of tricks together. The pistons are packed as recently described for *Britannia*, with rings of braided graphited yarn; glands with stranded yarn. Oiled paper gaskets are put between cylinder covers and flanges; ditto between steam-chest, cover, and port-face.

Erection is easy enough; clamp each cylinder temporarily in position against the frame, with a big toolmaker's cramp, in the position shown by the dotted lines in the recently-published frame drawing. Run a $\frac{3}{16}$ in. drill through the holes in both frames, and make countersinks on bolting face of cylinder. If the drill won't reach, braze an extension piece of $\frac{3}{16}$ in. steel rod to its tail. Remove cylinder, drill the countersinks 5/32 in. and tap $\frac{3}{16}$ in. × 40. Don't attach permanently, as we have to fit guide-bars and crossheads before erecting "for keeps."

Timing Diagram for *Sparky II*

Our contributor, "Meridian" writes — "With reference to the series of articles on the construction of *Sparky II*, I must apologise for an error concerning the timing diagram reproduced on page 72 of the issue dated January 17th.

"Both the transfer and exhaust periods are longer than the timing shown. Mr. Lines uses thin packing-pieces between the bottom of the cylinder and the crankcase in order to experiment with different timing. In the cross-sectional drawing this was allowed for, but the packing-piece was omitted when working-out the timing.



"I saw Mr. Lines recently and he tells me that best results are obtained when using a transfer opening of 0.040 in. I have prepared a new diagram, showing the timing corrected for this.

"It will be noted that the exhaust opens not much after half-stroke—somewhat earlier than in other types of two-stroke. It should not be forgotten, however, that racing engines seldom behave exactly alike even when made to similar designs, and some experiment with the timing might be helpful with other engines based on this design."

Novices' Corner

Forming T-Slots

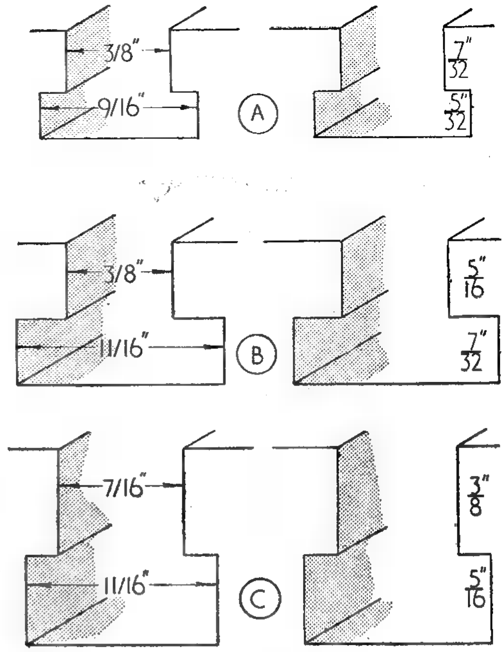


Fig. 1. T-slot dimensions : "A"—Myford M.L.7 lathe ; "B"—Drummond-Myford lathe ; "C"—standard heavy type slot

IT used to be [redacted] common practice with amateurs to make attachments for the lathe, such as vertical slides, from rough castings, for these sets of castings cost but [redacted] few shillings and could be finished with the aid of the ordinary workshop equipment. Nowadays, however, lathe manufacturers supply these attachments as standard accessories and, except on the score of expense, there is no longer the need of using castings and making the lathe fittings. Nevertheless, it is an advantage to be able to form T-slots, as these are essential in many tools and fittings built by enterprising workers who get greater satisfaction from making things for themselves.

When making new equipment, it is [redacted] good plan to copy the standard T-slots found in the machine tools already in use, and also where possible to give the slots the same spacing ; for other attachments, [redacted] well as the T-bolts, will then be interchangeable.

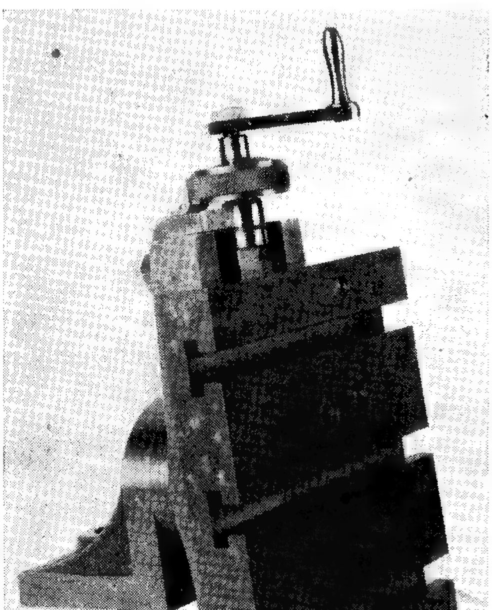


Fig. 2. Showing the T-slots machined in [redacted] vertical [redacted]

The size of the T-slots may be limited by the thickness of the castings used for the slides of machine tools, but these slots should always be made fully strong in order to resist damage when, by careless use, an abnormal strain is thrown on the parts.

The dimensions of T-slots in common use are shown in Fig. 1 ; the example (*A*) represents the slots machined in the cross-slide of the Myford M.L.7 lathe ; (*B*) shows a corresponding T-slot of the Myford-Drummond lathe ; and (*C*) is [redacted] scale drawing of [redacted] heavy type of T-slot used in machines designed for manufacturing purposes, where the possibility of rough handling has to be taken into account.

Machining a T-slot

The vertical milling slide illustrated in Fig. 2 shows the appearance of the three T-slots machined in the work table. This work was carried out entirely in a treadle lathe, as at the time there [redacted] electric supply in the district.

The actual dimensions of these T-slots [redacted] shown in Fig. 3, and the size of the slot depended in part [redacted] the size of the cutters then obtainable. After the table had been machined and a roughing cut taken over the work surface of the table, the slots were marked-out to correspond with those formed in the lathe boring table, in order to allow [redacted] machine vice and other attachments to be interchanged. As the casting may distort slightly as [redacted] result of cutting the slots, it is advis-

able at a later stage to take a light finishing cut over the table surface.

The method employed for machining the slots was first to cut a slot, equal in width to the bolt size, to the full depth of the finished T-slot by using a $\frac{3}{8}$ in. dia. end-mill. This slot will then provide clearance for the neck of the T-slot cutter that is used to machine the undercut portions corresponding to the head of the inverted T. The two stages of the machining operation are illustrated in Fig. 4. It will be apparent that the T-cutter will finish the slot to size at a single passage through the work and, as this means taking a heavy cut, the feed must be slow and carefully controlled. The actual cutter used is illustrated in Fig. 5. This tool is made of high-speed steel and was bought as post-war surplus; the head is $\frac{3}{4}$ in. in diameter, and it was this dimension that finally determined the size of the T-slot adopted; the teeth are 7/32 in. in width, and the shank is ground parallel to exactly $\frac{1}{2}$ in. diameter.

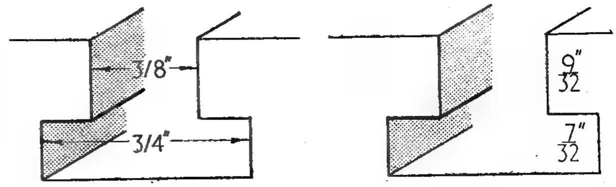


Fig. 3. Dimensions of the T-slots in the vertical slide (Fig. 2)

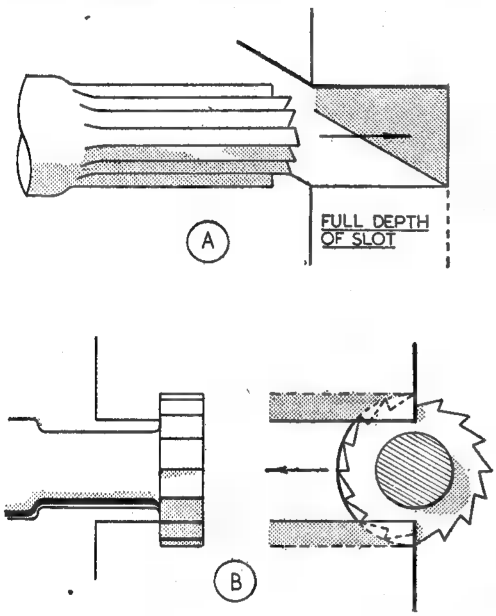


Fig. 4. "A"—end-milling the slot to full depth; "B"—undercutting the slot with the special cutter

It is essential that both the end-mill and the slot cutter should run truly when mounted in the lathe, for otherwise the brunt of the work will fall on only some of the teeth and the irregular cutting will slow the machining. Rather than use the self-centring chuck for holding the cutters, it is better to obtain accurate centring by employing the four-jaw chuck.

The centring is checked with the aid of the dial test indicator by bringing its plunger into contact with the teeth while the lathe mandrel is slowly turned by hand in the reverse direction.

Where the lathe is fitted with mandrel collets, these can be used to hold the cutters truly and, at the same time, the amount of overhang will be reduced to a minimum. An alternative method of centring the cutters is to make use of a mandrel adapter of the kind illustrated in Fig. 6. This fitting is accurately threaded by a screwcutting operation to fit on the mandrel nose and, when mounted in place, the adapter is drilled and finally bored to a diameter of exactly $\frac{1}{2}$ in. to carry the shank of the T-slot cutter and other standard tools. The $\frac{3}{8}$ in. dia. end-mill is also mounted in the same way by using a parallel, split collet, so as to reduce the diameter of the bore by $\frac{1}{8}$ in.

The cutters are secured in place by means of two Allen grub-screws and, if found necessary, two corresponding flats are ground on the shank of the T-slot cutter to keep it from turning in the adapter.

This mandrel adapter is well worth making, together with a few collets, for then not only can cutters be quickly set to run truly, but the reduced overhang and the freedom from obstruction by the chuck jaws make for better and more convenient working.

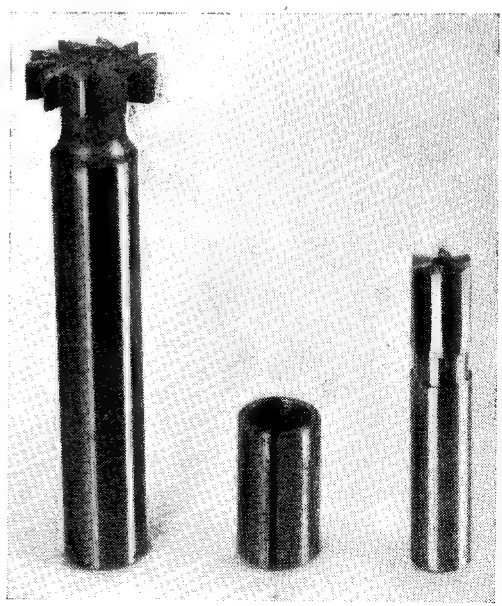


Fig. 5. The T-slot cutter and the corresponding end-mill with its collet

The casting in which the T-slots are being cut must be rigidly mounted, either by bolting the work directly to the lathe cross-slide, [redacted] by attaching the casting to [redacted] angle-plate that in turn is bolted to the cross-slide. The work is

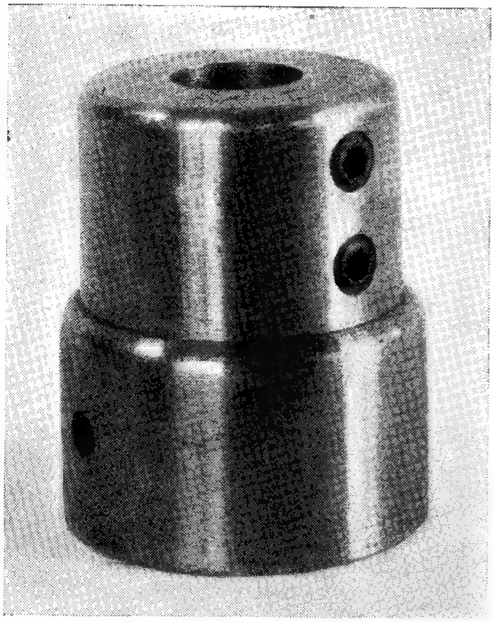


Fig. 6. A mandrel adapter for holding cutters

correctly aligned with reference to the lathe bed by means of [redacted] try-square, and is also set parallel to the face of the mandrel chuck or faceplate.

Cutting Speeds

The $\frac{3}{8}$ in. dia. end-mill has a circumference approximately 1/10 ft. in length. If, therefore, a cutting speed of 40 ft. [redacted] minute is used, the lathe can be run at 400 r.p.m. and the middle direct speed will probably serve. As in the present instance the diameter of the T-slot cutter is twice that of the end-mill, the mandrel speed must now be halved by using the low direct speed of the drive.

T-slots can quite well be cut in the shaping machine and, as with milling, this is carried out in two stages. First, the narrow portion of the slot is formed to the full total depth with [redacted] square-ended tool like [redacted] lathe parting tool. For undercutting the slot to form the head of the T, two specially shaped tools are required ; that is to

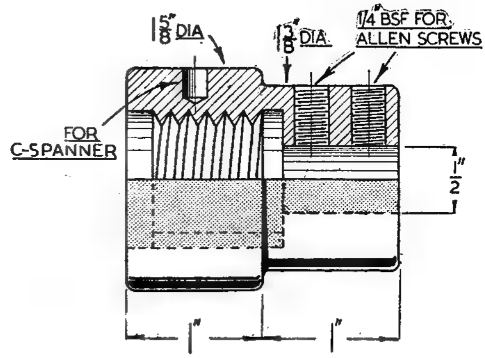


Fig. 7. Showing dimensions of the mandrel adapter

say, [redacted] for machining either of the two sides of the slot in the manner shown in Fig. 8. It will be clear that, when these L-shaped tools are used, the hinged clapper-box carrying the tool must be

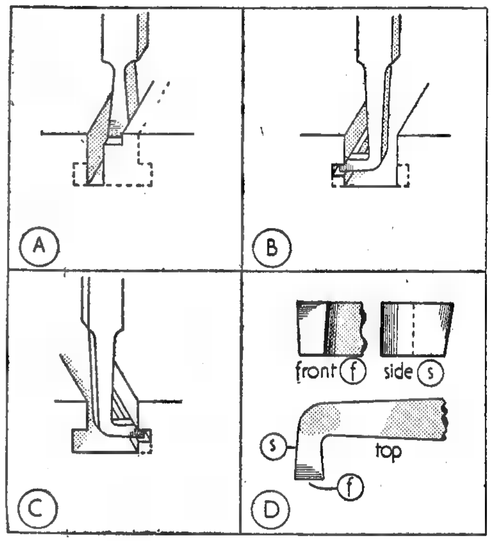


Fig. 8. Stages in shaping [redacted] T-slot : "A"—cutting to the full depth with a parting tool ; "B"—undercutting one side of the slot ; "C"—undercutting the opposite side ; "D"—the special undercutting tool

locked ; otherwise, the tool will rise on the return stroke and will tend to jam against the upper surface of the undercut slot.

A Useful Crack and Seam Filler

Here is [redacted] recipe which will be found useful for filling the cracks and seams which are often to be found in wood.

Heat $\frac{1}{2}$-pt. of linseed oil and dissolve in it $\frac{1}{4}$ lb. of resin, followed by [redacted] $\frac{1}{4}$ lb. of beeswax. Remove the pan and stir in 3 oz. of turpentine.

This mixture sets into [redacted] soft putty—but takes its time over it—and may be worked into the cracks or [redacted] with a putty knife. Any left over [redacted] be put in a tin and will do for next season—and several [redacted] after that, for it never sets really hard.

SMALL TOOL MAKING

by S. W. Hugo, A.M.I.Mech.E.

THE ability to make small tools is worthy of development, and in certain trades, particularly press tool making, is a very necessary part of the work.

Such items as centre- and D-bits, counterbores, etc., can be easily made from silver-steel ; [redacted] small bench lathe and hardening facilities are necessary, but even in the most specialised toolrooms these [redacted] available to the men at the bench.

Centre-bits

It is essential in making new pierce and blank tools and in repair work to transfer holes accurately from die to stripper and vice versa. The ordinary fitting shop method of putting a drill used to drill through. It is essential to use a perfectly ground drill and to ensure the minimum oversize, the sharp corner where land and cutting edge meet can be lightly " blunted " with [redacted] fine oilstone. The exact amount can only be dictated by experience. To bring the hole to size and finish, if a suitable reamer is not available, requires [redacted] D-bit type of reamer [redacted] shown in Fig. 3.

This is a very simple and easily used tool if made correctly. If made carelessly it is one of the worst imaginable. The secret is to obtain a definite back taper of about 0.0005/0.001 in., depending on size, along the body of the tool, away from the cutting edge, which is formed by

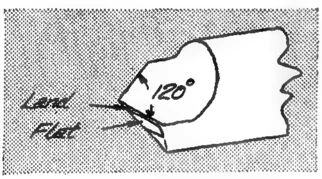


Fig. 1. Centre-bit

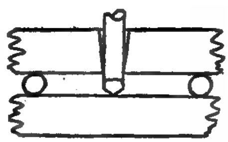


Fig. 2. The centre-bit in use

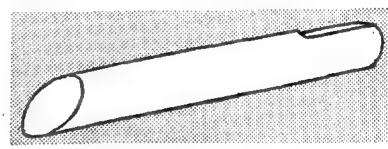


Fig. 3. The D-bit reamer

through the part already drilled, is not productive of the required accuracy or finish and may well damage the member through which the drilling is taking place.

Fig. 1 shows [redacted] type of centre-bit which can be used to obtain accuracy in spotting holes. It is made by turning the end of a piece of silver-steel to an included angle of 120 deg. and then filing down to the half-way line. For diameters above $\frac{3}{16}$ in. [redacted] flat may be filed back of the cutting edge to leave [redacted] 0.010 in. land. This may be seen in the sketch.

The body must be made to fit the hole through which spotting is to take place and the parts should be spaced away from each other with thin parallels or pieces of silver-steel in order to give clear working. This is illustrated in Fig. 2, which shows spotting taking place back through a die aperture. In this case spacing apart is absolutely necessary, as it can be seen that [redacted] accurate register cannot otherwise be obtained. Toolmakers' clamps are used to hold the components together ; these do not appear in the sketch.

These small centre-bits are, further, the only satisfactory method of obtaining [redacted] true start for small holes in the lathe, where even the smallest combination or Slocomb type centre-drill is far too large.

D-bits

After centring such [redacted] hole [redacted] drill, [redacted] few thousandths smaller than the required size, [redacted] be hollow grinding the end of the tool diagonally across its face, using the periphery of [redacted] fairly small wheel, as on [redacted] bench grinder. The shank may be flatted or squared for [redacted] grip. These tools do not remove much material, 0.001/0.002 in. on diameter at the most and should be used with copious lubricant on metallic materials. They work excellently on plastics but can then be used dry. They should be turned clockwise steadily both on entering and on withdrawing from [redacted] hole. Any tendency to seizure indicates ; (i) Too little lubricant, (ii) Too fast a feed, (iii) Insufficient back taper, (iv) Flattening of the taper back of the cutting edge. Such a tool, particularly if it bears any seizure mark, should be scrapped. These tools find their maximum utility in about three 0.001 in. steps above and below a nominal size, thus enabling various fits to be obtained with standard and oversize dowels, piercing punches, etc. When [redacted] number of them have been acquired it is advisable to check carefully with [redacted] micrometer the existence of the taper right up to the cutting edge before use. The cutting edge must also be reground lightly if it is at all blunt.

Counterbores

Counterbores of the two- and four-bladed type are easily made at the bench. The stages in production of both types are illustrated diagrammatically in Figs. 4 and 5. The idea of filing the spiral flutes [redacted] [redacted] four-blade counterbore seems to be very rarely practised, and yet, after some

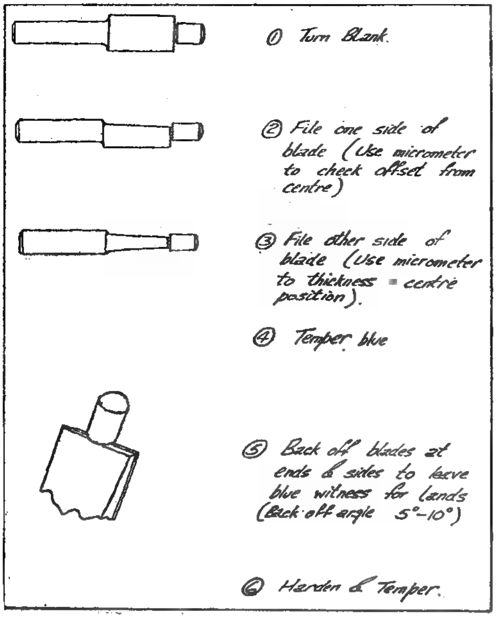


Fig. 4

little practice, perhaps beginning with straight teeth, it is quite easy, the tool being far better, safer, and less liable to breakage than the two-bladed type. Where only one counterbore is required it is far quicker than attempting to spiral mill. It is possible to make an average sized counterbore, complete including all heat treatment, in an hour or an hour and a half. Taper or other formed cutters may also be made. In all cases care is needed to leave a small but definite land to ensure the form of the cutter is not destroyed and to ensure reasonable life. The cutting edge must exist right in to the pilot and an undercut left in turning the blank will help. There should be no sharp corners at the bottom of the undercut, which should also be no larger than necessary. Needle files will be required, both 14 and 20 cm., for the backing off work. To get the teeth in to the pilot pin the bottom of the flutes will groove the pilot. For this reason the spiral angle should not be too "slow," otherwise the result may be to groove the pilot pin so much that it loses its register diameter. This is a fault that may trap the unwary beginner.

A simple fixture is shown in Fig. 6, which will speed up the production of small batches of counterbores. It is a square block into which the shank of the counterbore is fixed by means of a sunk grub-screw. Straight flutes only may be end-milled into the blank, the assembly being turned and regripped in the machine vice after each cut.

Counterbore as Line Reamer

The type of counterbore described can be used successfully as a piloted reamer. The writer has in his possession one with the blank sizes shown in Fig. 7. The method of use is shown in Fig. 8 and represents the accurate aligning of a piercing punch hole in a new stripper, the pilot working in the die. Note that the pilot must be long enough to engage the die before the tool starts cutting. The type of punch for which this operation may be necessary on the repair bench is the standard shouldered type, also shown in Fig. 8.

Heat Treatment

Silver-steel is generally reckoned to be 0.9 per cent. carbon electric crucible steel, although various types contain low alloy additions. These, however, do not upset the fundamental hardening temperature of about 780 deg. C., full cherry red. The best quench for the above type of tool is in cool thin oil. Beware small containers of oil which may have become very heated by continued use. The tools may be heated in tongs in an air-gas flame and only the cutting edge area need be of the required temperature. Heating in an open flame tends to oxidise the steel which, after quenching, appears black and sometimes blistered. The coating all over of the tool with soft soap, or failing this, with ordinary soap will obviate this and give a bright silvery colour after quenching, which may either be retained or polished off locally to observe subsequent tempering colours. Tempering can be done in an open flame, though an oil or salt bath is preferable. If using an open flame, clean and

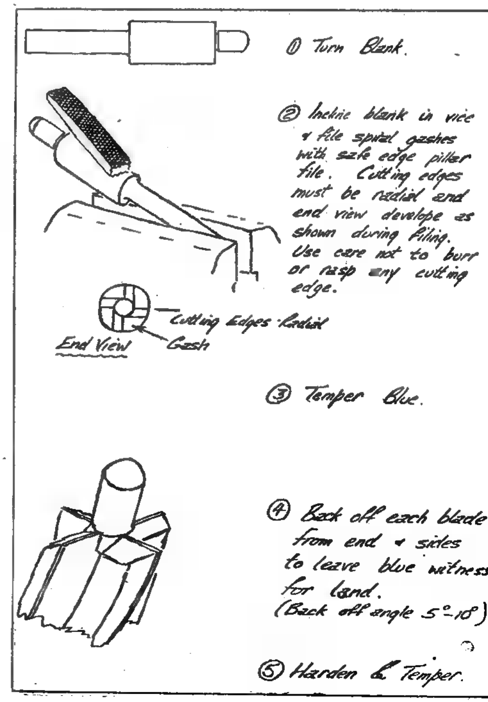


Fig. 5

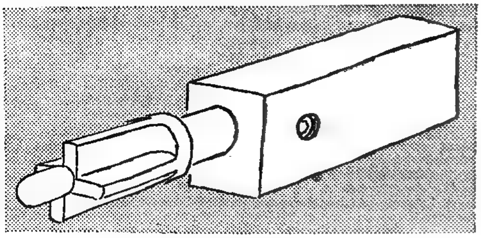


Fig. 6. Milling block

polish the tool, removing any sign of oil or grease and, gripping in dry tongs, heat very gently all over but with more emphasis on the shank. By this means [redacted] good slow run of colour will be obtained up the body of the tool toward the cutting edges. A narrow band of complete colour range as will be obtained by too strong heating of the shank locally is very poor. Medium straw is generally the most satisfactory colour on the cutting edges, except for the centre drills, which [redacted] be considerably harder. The matter of temper is [redacted] which can only be finally decided by the type of material being cut and other circumstances.

It might be pointed out here that [redacted] plain carbon tool steel is still one of the best "cold cutters" available, its initial hardness being [redacted] point or two higher than most other cutting steel alloys. The superiority of the latter lies only in their maintenance of hardness at elevated temperatures, i.e. their suitability for use in machines where the power expended in heat at the cutting edge would be more than sufficient to temper and soften straight carbon tool steels. For this reason the use of silver-steel counterbores in particular at high speeds in drilling machines or lathes should be carefully watched lest their temper be drawn.

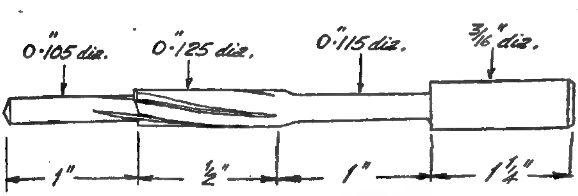


Fig. 7. Counterbore—reamer

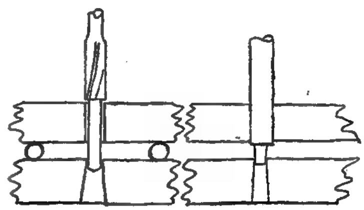


Fig. 8

Drills, taps, reamers, dies, etc., may be made from silver-steel for satisfactory low duty use, but the manufacture of these lies along conventional machining lines.

The Physical Society's Exhibition

The Physical Society's 36th annual exhibition of scientific instruments and apparatus will be held from Thursday, April 3rd to Tuesday, April 8th, 1952, excluding Sunday.

As in 1951, the exhibition will be located in both the Royal College of Science main building, Imperial Institute Road, S.W.7, and the Huxley Building, Exhibition Road, [redacted] representative selection being exhibited in each building. The entrance to the Huxley Building is opposite the Science Museum. Tickets will be valid for entry into both buildings: on Thursday morning and afternoon, April 3rd, the exhibition will be open to members of the Society and Press only.

Present circumstances, both national and international, render the 36th exhibition of instruments and apparatus of great interest to all users of instruments. The rearmament programme has caused a great resurgence of interest in a wide range of equipment for service use and continued need for higher productivity and increased exports has led to ever-increasing developments in the field of industrial instruments.

As the importance of British science [redacted] a national asset is being increasingly recognised, much new equipment has been designed for pure and applied research laboratories, and much of all types of equipment is [redacted] view in the Huxley Building and the Royal College of Science.

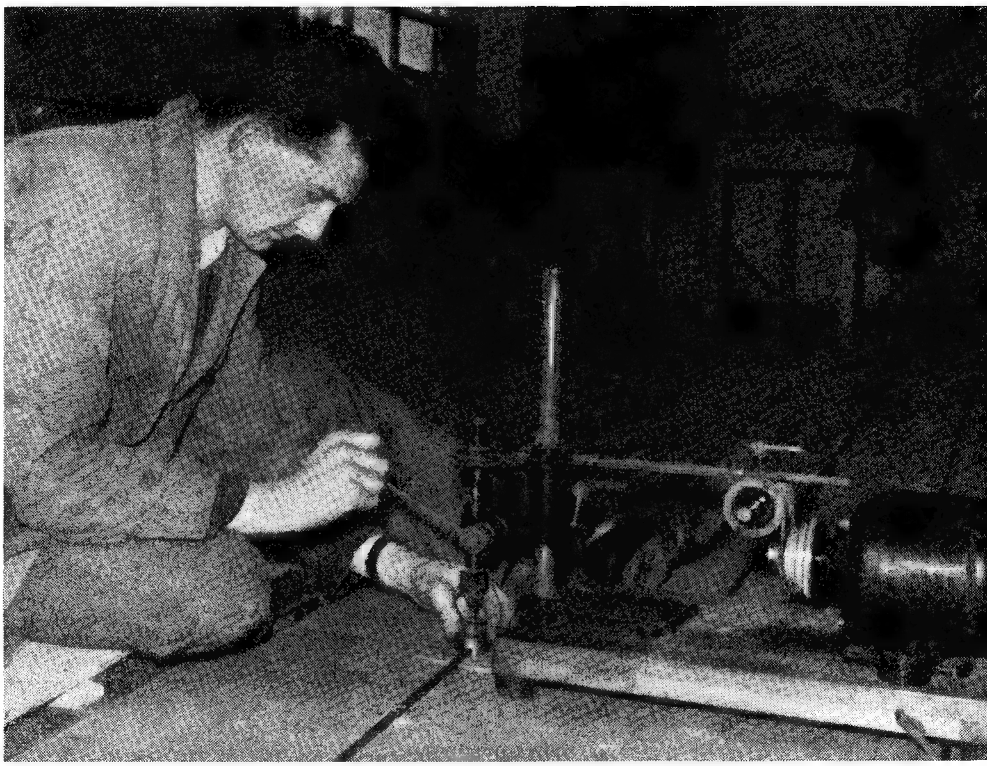
Discourses will be delivered by eminent scientists [redacted] Friday, April 4th and Monday, April 7th, and the prize-winning entries of the Society's craftsmanship and draughtsmanship competition will be on show. This competition is assuming increasing popularity and importance among instrument-making firms and is another example of the service the Physical Society is undertaking in the national interest.

The handbook of the exhibition containing the description of exhibits will be available from the Physical Society early in March, price 7s. 3d., including postage.

MAKING TRACKS!

F. G. Buck describes the construction of the Meteor Club's Miniature Grand Prix Circuit

As readers will already have seen, Grand Prix racing on a small scale has begun, and [illegible] with "cable" racing in this country, the writer has been privileged to have been in it right from the beginning.



The end of the journey! F.G.B. drills the last of some 1,000 *holes with the aid of a reversed drilling machine. The drilling jig is clearly seen*

It is now some eighteen months since Mr. Baigent first made known to me his idea for guiding model racing cars, not merely round [illegible] oval or circle, but round left- and right-hand bends, even down to those of hairpin proportions. After much thought on the matter, it was quite obvious that the possibilities were very great indeed.

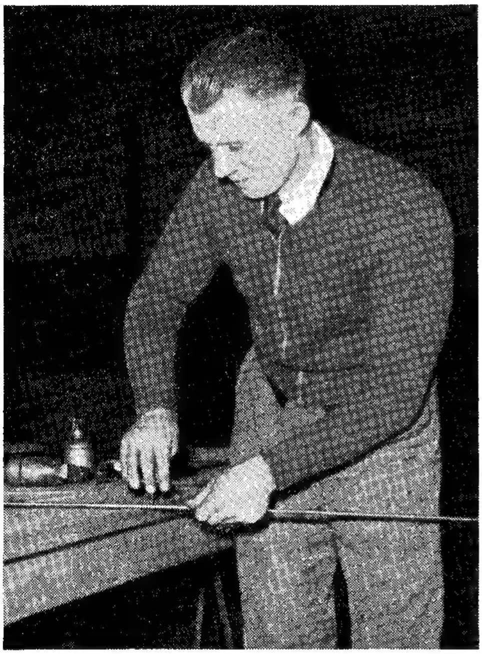
To be quite sure about the whole thing, the writer laid down [illegible] small single-rail circuit of some 33 ft. in [illegible] room 12 ft. × 10 ft., which alone gives some idea of *one* of the system's advantages, and round this tiny track ran [illegible] small car powered by a 2.5 c.c. "diesel" engine which on a "cable" track attained a speed of 55 m.p.h. Clutches were fitted in each of the rear driving wheels and while the m.p.h. was, of course, nowhere near 55—thank goodness!—it was, nevertheless, rapid enough to be comparatively awe-inspiring. After subsequent demonstrations to fellow members of the Meteor Club, it was unanimously decided to go ahead with the construction of [illegible] track on which four cars could race together.

In our particular case, having no land of our own [illegible] which to build [illegible] permanent circuit, [illegible] had to design [illegible] portable one which, while being simple and quick to lay out and remove after use, had also to be strong enough to stand general wear and tear over [illegible] long period.

One of the best features of the G.P. system is its ability to be laid in [illegible] room or situation of almost *any* proportion, and pillars and posts [illegible] of [illegible] consequence whatever. We were,

therefore, able to make full use of the floor space in the canteen of Messrs. Rists Wires and Cables, Newcastle-under-Lyme, Staffs, which the firm has most generously placed at the club's disposal for model car racing. In addition to this, permission was also given for the track sections to be stored on their premises, which greatly facilitated the proceedings.

Various shapes of circuits were considered and eventually one devised and drawn to scale from which all calculations in the way of materials were made. No specific endeavour was made to employ a circuit measuring a definite portion of a mile, as the racing was to be between the cars



S. Robinson " holds his breath " as well as a rail, whilst tapping one of the holes 6 *B.A.*

themselves and not against the clock ; therefore, actual timing of the cars in so many seconds was quite unnecessary, though a system of lap counting is a highly desirable requirement for the future.

The Meteor track does, in fact, measure a little under 200 ft. and is large enough to allow the cars to attain quite high speeds, too high, in fact, and a system of automatic braking is now in course of preparation.

The first requirement for the construction of the track was the foundation to which the guide rails were to be fitted, and after much investigation a form of Swedish hardboard was found to be most suitable and was, moreover, readily obtainable in the sizes required.

On the straights we employed sections of 10 ft. × 4 ft. and shorter lengths in proportion for the various bends, one of which incorporated the minimum radius permissible of 3 ft. The circuit was so arranged that the cars entered the hairpin immediately following a long sweep round, which had a slowing effect (especially with brakes fitted) and at the end of each straight there was a bend of " easy " proportions in order to help avoid excessively violent manoeuvring on the part of the cars, to say nothing of reducing the number of G's imposed on the unfortunate drivers !

While the track at the " M.E." Exhibition was the same as ours in plan, we do, in fact, run our cars in the opposite direction—i.e. anticlockwise, to attain the above results.

The next large item required was the guide rail material, and as $\frac{5}{16}$ in. diameter bar or tube had now been decided upon as a " standard " measurement, steps were taken to purchase the necessary quantity. Close on 1,000 ft. of round bright mild-steel bar was readily obtained—before Nationalisation of the steel industry—from a local ironmonger.

As the guide rails have to be placed a distance of 0.150 in. above the track surface, it was necessary to obtain a large number of steel spacers, and after attempts to produce these on a small centre lathe without the aid of capstan attachments, we decided to delegate the job to a specialist firm, who supplied the required number, nearly one thousand, for a very reasonable sum.

It was decided to use one spacer at every foot in order to reduce buckling tendencies on the part of the hardboard, and this decision was a very sound one. Incidentally, the writer would like to emphasise that the tolerance of 0.150 in. ± 0.010 in. for the spacer height, as laid down in the track dimension rules, relates to this variation between individual *tracks*, and *not* individual spacers, which should be held to as near one size as possible—a most important point.

Construction

The first stage was to mark out in chalk on the canteen floor the positions of the boards, and the fact that the scale plan had been drawn on graph paper was of much assistance here. The boards were then sawn to shape as required and then fitted with connectors, which enable the sections to be locked together.

Very simple and effective connectors were made by employing strap hinges from which the hinge-pins had been removed. One of these was fitted to each side of the track where the sections joined, care being taken to see that they were in such a position as to be clear of the cars' wheels ; 2 B.A. countersunk-head steel screws and self-locking nuts were used to secure the hinges to the boards.

In practice, the sections are pushed together for assembly, the hinge formation ensuring alignment, and when in position, an easy fitting pin is pushed through the two halves, thus locking them together.

Before any rail laying was begun, the whole track was cut and assembled as far as the sections were concerned, so that when the rails were being fitted we could work on one section at a time with the certain knowledge that they would all couple up correctly when completed.

For securing the rails to the board, holes were drilled vertically straight through both rail and base, after the rail had been bent to shape and

laid in the correct position. The drilling was done by the aid of a small pillar drill reversed on its column, and a jig fitted with a hardened steel bush to ensure that the drill started and remained central throughout. The holes in the rail were subsequently tapped 6 B.A. by a team of "Tappers," who broke remarkably few taps in the process! The holes in the hardboard were opened out to 6 B.A. clearance and countersunk on the underside.

When a section was ready for assembly, it was lifted on to two or more tables and screws inserted from underneath through first the board, then the spacer and into the rail itself, afterwards being screwed home tightly.

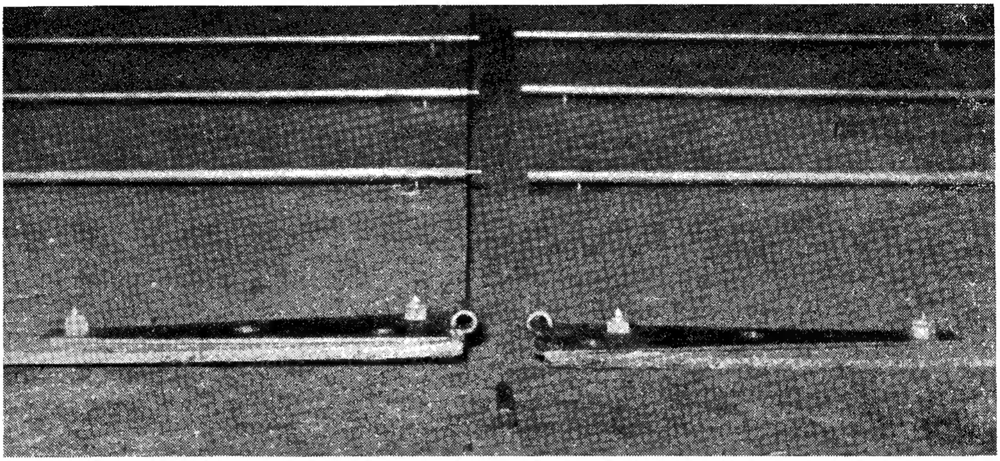
Immediately prior to drilling, the rail ends had been cut to length, trimmed and drilled centrally, again by the aid of a simple jig. Into one end was driven a dowel consisting of a piece of 10-gauge piano wire, leaving about $\frac{3}{16}$ in. protruding, and the opposite rail end drilled clearance. This enables the rail joints to be correctly aligned.

The bending of the rail could possibly be done by hand, but a much smoother curve results from the use of a simple bending machine which was constructed and arranged to be used flat on the floor in order to support the rail and avoid twisting.

On the section fitted with the "stops," which are moved aside to release the cars from the grid as required—either collectively or individually—notches are cut in the sides of the rail to enable the cars to be secured to or removed from the track. These positions are staggered so as to avoid the operators getting in each others way while fitting their cars to the rail; but once on the rail, the cars are moved up level with each other on the starting grid.

At the present time, the best method of starting the cars' engines appears to be off the track, by the aid of electric starters of which there should be four for the utmost convenience. When the engines are running the cars are then fitted to the rail and moved up to the starting grid ready for the "off." One soon acquires the knack of holding down engine revs. before the wheels are actually on the track, but "diesels" do not appear to "scream their heads off" under conditions of little or no load when settings are correct for running on the track, unlike their i.c. engine counterparts.

This, then, gives some idea of the manner in which our track is constructed, and to those who are contemplating a similar venture but are apprehensive about the amount of work entailed, it may be as well to mention that we were most agreeably surprised to find that the work proceeded considerably more quickly than was anticipated, and the track was completed many weeks ahead of schedule. With an average of five or six members working one evening a week, and a whole day's work about once a month, the actual constructional work was completed over a period of approximately four months.



Illustrating the rail end dowels and "strap-hinge" method of aligning and locking the sections together

This is not the place for a discussion on the many advantages this type of racing enjoys, but it must be mentioned that enthusiasm in the Meteor Club runs high, and it has been possible to considerably increase membership, as the track can cope with four members at a time instead of only one while the rest queue up!

We are now in the midst of much experimental and development work, and as we now have a 1.5 c.c. car going *too* fast [*sic*] we are finalising a simple braking attachment which will reduce the car's speed a great deal on the bends, whilst allowing it to be free to accelerate away again up the straight.

There are problems, of course, but these help to make the whole thing worth while. To those who may criticise some of the immediate aspects of the system, I would say: The ideal can rarely be attained instantly; so be patient, and remember—we *enjoy* the *Per Ardua* as well as the *Ad Astra*, for should the latter be attained without the former, there can be no spirit of achievement whatever.

PRACTICAL LETTERS

Rust Prevention—and Lost Lunches !

DEAR SIR,—Recently, letters have been published in THE MODEL ENGINEER on the subject of rust. Now, it seems to me just a display on how rust is formed scientifically, so I thought I would tell you of a practical way of preventing rust, an idea I have used for five or six years. First, like "L.B.S.C.'s" fireman Pat, "stop it before it starts!" I give my tools, lathe, press drill, etc., a thick coating of XL motor oil, then press the wax wrapper off a loaf or two of bread, to get rid of air bubbles, on to the bright parts of the tools. I have had parts covered for three or four months with this simple method and the parts are still silvery. My workshop is made of Anderson shelter sheets tarred inside and outside, the ends of the workshop being built of brick, and being more of an engineering turn of mind than a bricklayer, I did not put ventilators in, so condensation is terrific.

Some time ago, in one of "L.B.S.C.'s" chats, he mentioned cooking a lunch of meat on the fire-shovel in the firebox. He should have had No. 1 form to fill in for bringing back memories that neither he nor I will ever have realised again. I wonder if "L.B.S.C." has ever lost his meat up the tubes when his mate, forgetting the important job of cooking, has opened the regulator ?

Yours faithfully,
"FIREMAN."

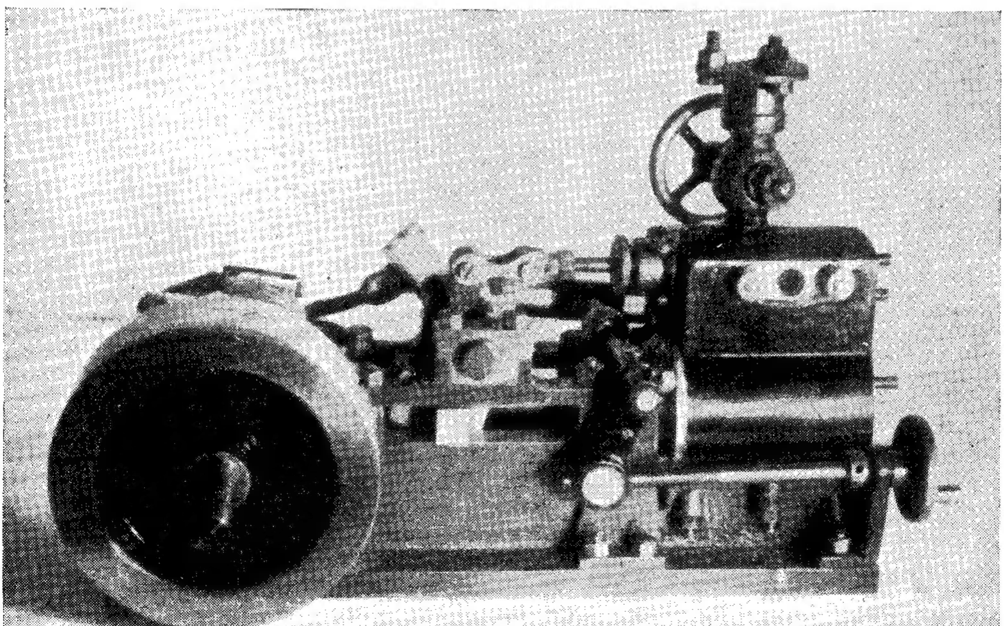
Birmingham.

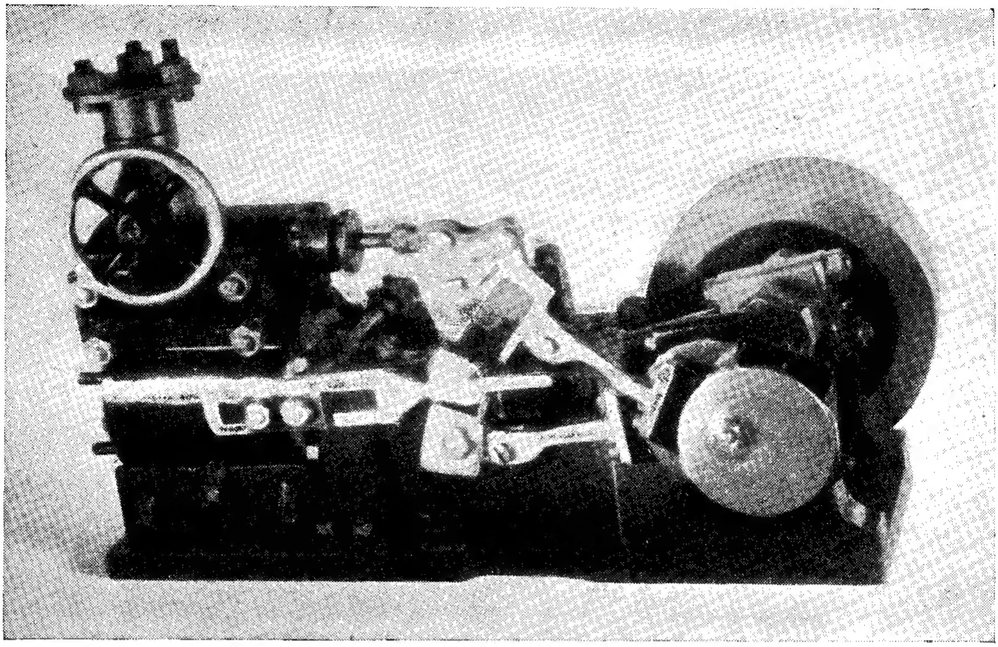
Photographing a Model Steam Engine

DEAR SIR,—With reference to my article on a small horizontal steam engine published in the issue of January 3rd, I regret that I was unable to submit photographs of the engine in time for you to publish them with the article. The two photographs, reproduced herewith, show both sides of the engine. Incidentally, in view of the interest now being taken by readers in photographic apparatus and methods, they may like to know how these photographs were produced.

The camera used was of the ordinary folding type with focussing movement, having a lens of 7.5 cm. focal length, with an aperture of f./3.5. With the limited extension of the camera, it was not possible to get the lens into focus for a close-up picture of the engine, but the difficulty was overcome by the use of a supplementary lens taken from a pair of old binoculars. This was fixed in front of the camera lens with adhesive tape and experiments made with a piece of ground glass in place of the film. It was then found possible to obtain sharp focus with the camera 11 in. from the object, and by stopping the lens down to f./22, a reasonable depth of focus was obtained. Illumination was obtained by a 75 W lamp 4 ft. away and at 80 deg. to the camera. The exposure was 60 sec., using Sellochrome film.

Since the article on the engine was written,





some slight modifications have been made, including new eccentrics with split straps, and oil holes. The original straps had become a trifle sloppy after approximately fifty hours running. The new eccentrics are shown in the photograph.

With best wishes to THE MODEL ENGINEER and its contributors.

Yours faithfully,
Blackburn. H. GRAYSON.

Lathes

DEAR SIR,—With regard to the letter from Mr. W. Kirkham published in THE MODEL ENGINEER dated January 3rd, 1952, I would like to express agreement with the request for articles dealing with lathes. There is already an ample supply of first-class information and guidance on *using* lathes, but details of lathes themselves are sadly lacking. It seems there are many manufacturers who seldom or never advertise in THE MODEL ENGINEER. Also, when perusing the "Sales and Wants" I often see a lathe mentioned by name and have no idea what it looks like, through not having seen it advertised.

If a sufficient number of readers are interested, an illustration and brief description of all current and recent British lathes, up to say $3\frac{1}{2}$ in. size, could be supplied either by articles or by means of detachable leaflets in THE MODEL ENGINEER. These could be stored in a file for easy reference and new leaflets added as they become available. It should also be possible to buy a complete set from the publishers.

As a matter of interest, a new book entitled *The Watchmaker's Lathe* (N.A.G. Press Ltd.) includes details of all British, French, Swiss, German, American and other watchmakers' lathes, so that this type is well documented.

One more suggestion. Those who require a $3\frac{1}{2}$-in. lathe are extremely well catered for, and have unparalleled value in the Myford M.L.7. Could the Myford Engineering Co. be persuaded to produce a lathe of about $2\frac{1}{4}$ in. size, with screwcutting gear optional? Good-quality lathes of this size are mostly of the instrument type, in which the mandrel is designed for the use of collets only and they have no lead-screw. This type is not so adaptable for model and general work, and their very high cost puts them beyond the reach of most amateurs.

Yours faithfully,
Belfast. W. G. MARTIN.

Man or Horse?

DEAR SIR,—In your issue of January 24th there appears a letter from Mr. J. Davies enquiring about the use of "manpower" instead of horsepower.

I am afraid that the question is most complicated, as, apparently, nationalism enters into the calculation!

The *Year-book of Facts* for 1840 quotes from Bennet's *New York Herald*, a description of an electro-magnetic machine then on display in New York, which had a wheel 16 to 17 ft. in diameter with magnets arranged round it and in it, and which was activated by a large galvanic battery.

The article states, "The wheel is equal in power to that of two able-bodied Irishmen, in giving movement to any kind of machinery."

Yours faithfully,
Liverpool. A. D. FALLOWFIELD.